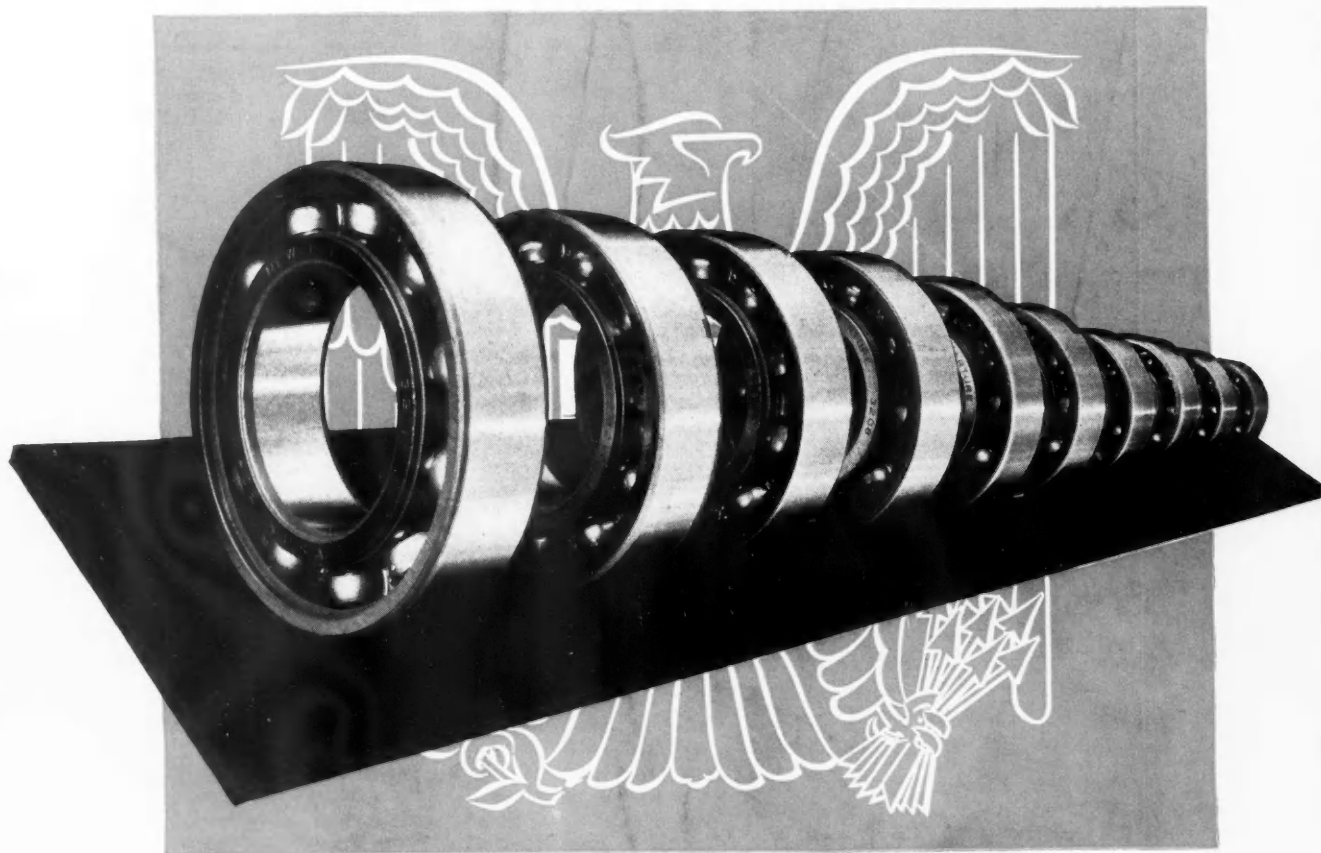


DEC 15 1943

# AUTOMOTIVE *and Aviation* INDUSTRIES

DECEMBER 1, 1943



## ON EVERY BATTLEFRONT

—keeping them flying, rolling,  
moving, at every point where  
shafts turn, where motion must  
be friction-free.

*New Departure*  
BALL BEARINGS

# Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs.

**DECEMBER, 1943**

## Recheck cutting fluids to check tool waste

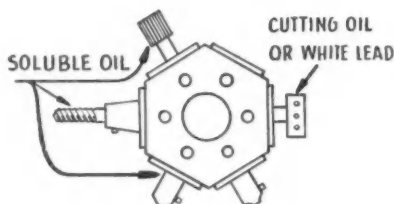


In the rush to retool plants and put war jobs into production, cutting fluid requirements could not always be given due consideration. That's one reason you'll find that a recheck of the coolants used on your machining, grinding, and stamping operations now may be the most productive check you make on tool waste.

In addition, many new products have been developed by Standard Oil. Some of these were not available when you first selected cutting fluids.

Make a cutting fluid analysis the first step in your tool conservation program. Let a Standard Cutting Oil Specialist help you. Just call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Illinois. In Nebraska, contact any Standard Oil Company of Nebraska office.

**Stanicool H.D. eliminates need for two oils on turret lathe.** Carboly tools on a turret lathe required a soluble oil, but a threading operation on the same lathe required a cutting oil to give reasonable die life. This meant swabbing the die with cutting oil, which then had to be cleaned from the bomb part being machined. At another plant, in machining steel bolts on a turret lathe it was necessary to use white



lead on the threading operation to get smooth threads, although soluble oil was needed for the other operations. Both plants switched to Stanicool H.D. Soluble Oil for both machining and threading at the suggestion of a Standard Oil Engineer. In both cases, threads improved and tool life was

lengthened without sacrificing the cooling quality needed on the other operations.

Stanicool H.D.—a heavy duty, emulsifiable oil—will do many of the in-between jobs on which a cutting oil won't give adequate cooling, and a conventional soluble oil won't give the required finish or tool life.

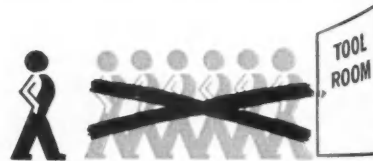
**Confidentially it . . . doesn't any more.** Cold reduction of steel tubing was a "hot" job at a Detroit plant when mineral oil was used as a die coolant. There were a number of difficulties. Tubes were too hot to handle when they came off the dies. Die life was short. Tubes rusted because not enough oil remained on them. The oil had an objectionable odor, and so did the whole job, the management decided. A Standard Cutting Oil Specialist was called.



in. He suggested use of an emulsion—Superla Soluble Oil. With it, the tubes were naturally cooler—they could be handled barehanded. Die life also improved and rusting was eliminated. To top it off, the mineral oil product cost over 70 cents per gallon—odor and all—while the Superla Soluble Oil mix cost 5 cents per gallon—without the extra scent.

**Cutting oil in place of kerosene doubles tool life.** Machining bronze on a turret lathe wasn't a particularly difficult job at one Indianapolis plant. Kerosene was used as a coolant. Its viscosity was light, it did not stain the work, and it was easy to get. But tool life wasn't exactly good. One of the new Stanicut oils, developed to meet the increase in machining of non-ferrous metals in war plants, was tested. It, too, had the right viscosity and cooling qualities, did not stain the work and was readily available. But it also doubled tool life. Take advantage of new cutting fluid developments by talking over your machining, grinding, and stamping problems with a Standard Cutting Oil Specialist.

**Chasers were ground every 3 days — now every 3 weeks.** One-seventh as many trips to the tool room for regrinding



represents a big saving in tool life. But until a test was made at a Chicago plant, grinding chasers every three days was a routine part of the job of cutting 1 1/8" x 16 external threads on Nos. 43 and 13 aluminum die castings. Then Stanicut 137 BCS was tested. Dies now last three weeks—some as long as 45 days—without regrinding. Why? Stanicut 137 BCS has the right kind and amount of additives to handle tough threading jobs like this. Here is another product developed by Standard Oil to solve war-born cutting oil problems.

*Oil is Ammunition . . . Use it Wisely*

## STANDARD OIL COMPANY (INDIANA)

**STANDARD  
SERVICE**



# AUTOMOTIVE and Aviation INDUSTRIES

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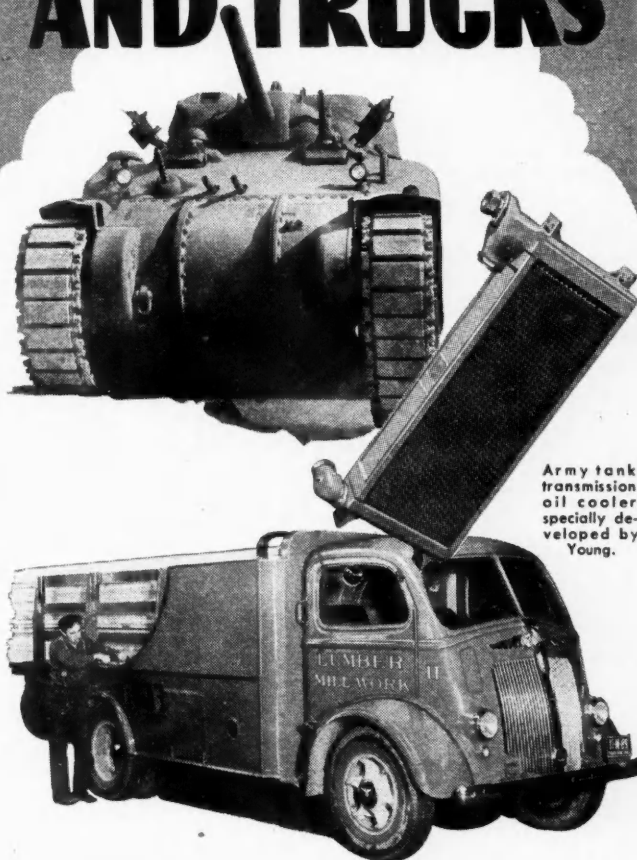
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December 1, 1943

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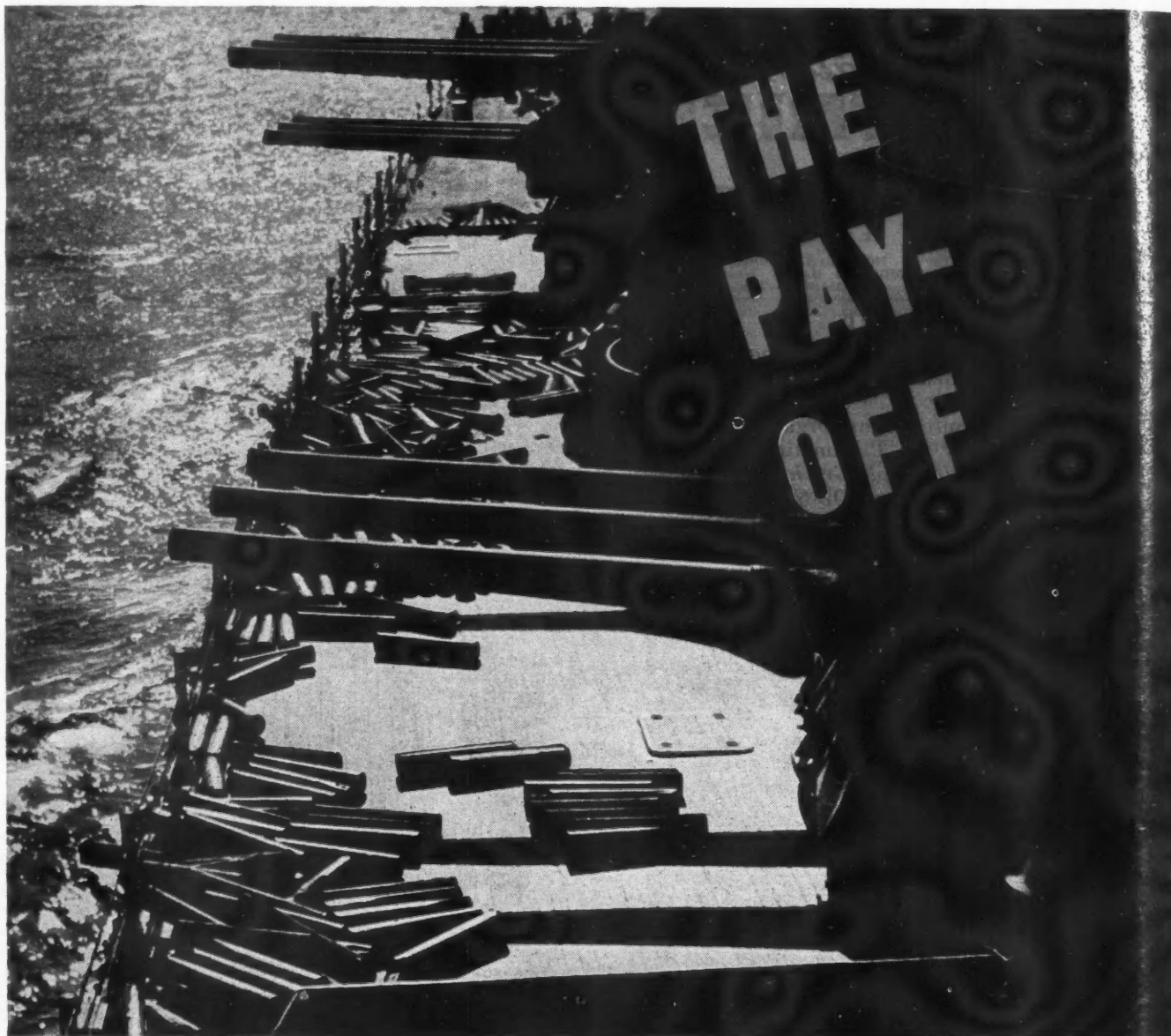
**AIRCRAFT STEEL & SUPPLY CO.**, Wichita, Kansas

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PRODUCE MORE  
SALVAGE SCRAP  
WIN THE WAR

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In the high-speed machining of shells, guns, tanks, planes, ships, *Texaco Cutting Coolants* are playing a vitally important part.

*Texaco Cutting Oils* permit higher

speeds and feeds, assure greater output. They lubricate the tools, and by carrying away heat, prevent chip welding, improve surface finish and lengthen tool life.

A Texaco Engineer specializing in cutting coolants is at your service through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

#### THEY PREFER TEXACO

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**TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING**

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT - CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY



## AUTOMOTIVE and AVIATION INDUSTRIES

Volume 89 December 1, 1943 No. 11

### Manpower Shortage in the Bearing Bottleneck 17

Every tank, every plane, every motor car for the army or navy has countless bearings of many types and sizes. They are imperative parts. Top production is hardly adequate for the needs. The growing shortage of manpower is creating a situation that might well bring the war production program to a serious barrier. Here the whole situation is brought out into the open. Read this article.

### Improvements in German DB-601 N Engine 22

What the enemy is doing to improve the performance of her fighting machines is not only of engineering interest but important because it is an enemy development. This description is most complete and liberally illustrated.

### More Details of the Lockheed P38 Fighter 30

Here are three more pages of drawings, and keys to them, to supplement the description of this plane that created so much interest in a recent issue of AUTOMOTIVE and AVIATION INDUSTRIES.

### Morris Armored Car with Frameless Chassis 33

There are several novel engineering features of this British army car. Our Correspondent in Great Britain has been able to present a lot of the details that should make interesting reading.

### Reduction of Assembly Time 34

In these days when time is such an important element in production this system should be of more than usual interest.

### Air Cargo Problems 40

The day is not far distant when shipping by air will become a larger element in our daily routines than in the past. The author of this has drawn on the SAE Air Cargo Engineering meeting for his material and brings to the front many new thoughts.

## AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

## Democracy in Reverse

By Julian Chase

**I**T MUST be true. So many competent men, keen in their perceptions, sound in their judgments, conservative in their utterances, have said it that there can be no doubt about it. Senators and representatives of both parties, economists, political and social scientists, top-flight business men and millions of us who speak with less authority say it every day with firm conviction in words of various weights. It is a fact, unquestionably—an astounding fact. It is a fact which tends to render completely and tragically futile all of our heroic efforts in this war to save our nation and to save our skins. It is a fact which progressively and most effectively nullifies the basic principles set up by our glorious forefathers in building a foundation for a great Land of the Free.

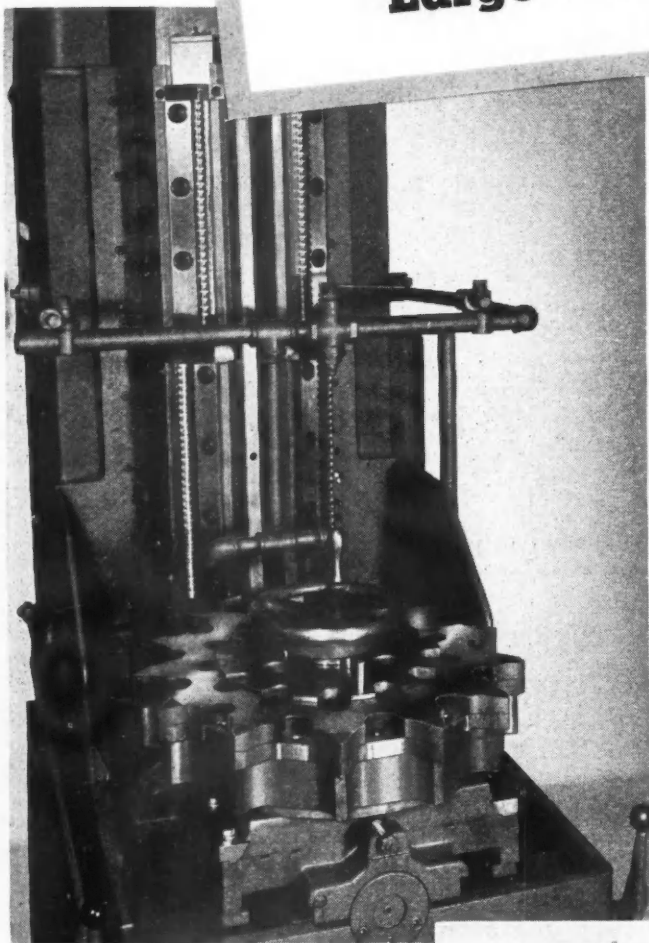
The United States of America, during the past ten years or so, has been heading rapidly away from democracy toward totalitarianism, toward a condition in which The State is The Thing and the individual is merely a minor and more or less inconsequential part thereof. It is a staggering, widely recognized fact, but what is being done about it?

What can be done about it? Everyone can do something. Many are trying. Some can do much more than others. But those who could do most are, unfortunately, in a numerically small but momentarily controlling group which "is burrowing its head in the slums and its hand in the ballot box" while, as a hard-headed Democratic congressman recently put it, "representative government is withering before our eyes."

To work as it can work, as it has worked for the upbuilding of the individual, for the benefitting of Man, the most important thing on earth, democracy needs broadly competent, brave and intellectually honest leadership. It needs leadership which fully appreciates the truth of the old and tried belief that the best way in which to help a man is to help him to help himself. It needs leadership which knows the limitless value of individual initiative and free enterprise and has the guts to fight for these basic principles of Americanism, scorning demagoguery as a means of holding its job. It will take that kind of leadership to reverse our present course and head us back toward real democracy.



## New and More Economical Way of Finishing Large Tooth Profiles

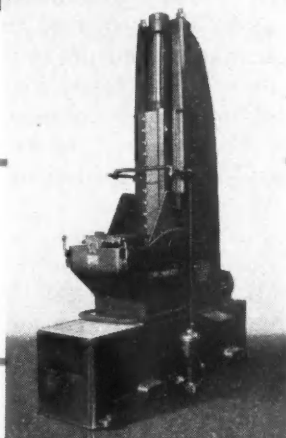


The teeth of large sprockets, especially those which are comparatively thin, present several problems in machining. Not the least of them is how to obtain the correct profile and a good smooth finish, while maintaining a satisfactory rate of production. After analyzing the various requirements, CINCINNATI Service Engineers decided that a job of this type could be done more economically by the *broaching process*. The illustration at left shows how the part was tooled up on a CINCINNATI No. 10-66 Single Ram Hydro-Broach Machine with receding table.

The secret to the success of this equipment lies in the arrangement of broach inserts. *They are made in three sections, each having a simple curvature. Inserts are mounted on sub-plates, and each section may be independently adjusted.* The opposite faces of two different teeth are broached in one pass of the ram. A hand indexing fixture, operated during the return stroke of the ram (and while the table has receded), holds one sprocket.

CINCINNATI Service Engineers have many years of experience in solving unusual machining problems by the economical surface broaching process. They will be glad to study your production methods for possible improvements.

● CINCINNATI No. 10-66 Single Ram Hydro-Broach Machine. Complete engineering specifications may be obtained by writing for catalog M-886. For a quick picture of these machines, look in Sweet's catalog file for Mechanical Industries.



**THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U.S.A.**

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

## Manpower Shortage

*and tremendous demand worsen*

## Bearing Bottleneck

**M**ANPOWER shortages are being felt in virtually every war industry, but nowhere is this more evident than in the bearing industry. Manufacturers of ball, roller, engine and needle bearings all are affected by this lack of labor, which is reflected in their deliveries to prime contractors. Some Washington sources estimate that bearing output could be stepped up by as much as 20 per cent if all manufacturing facilities could be operated at capacity through the utmost utilization of manpower. Such bearing manufacturing centers as Detroit, South Bend, Ind.; Meriden and Bristol, Conn., and Indianapolis are classified as Group I critical shortage labor areas, while Stamford and Torrington, Conn.; Philadelphia, Cleveland, Dayton and Canton, Ohio; Flint and Chicago, also sites of large bearing factories, are classed in Group II, where there is a labor stringency or an anticipated labor shortage.

In an effort to coordinate the procurement of bearings for the various claimant agencies, the War Production Board recently brought representatives of the Army Air Forces, Ordnance Dept., and Navy Bureau of Aeronautics into the Tools Division in Washington to centralize responsibility and expedite shipments on war orders. Bearings are classed as "B" products in the Controlled Materials Plan, so the various claimant agencies have no direct control over the ordering of these components. WPB recently mailed exhaustive questionnaires to the 30 largest users of bearings to obtain a breakdown of their usage by end products, by months and by sources of supply. In this way it is hoped that a better over-all picture of the bearing situation can be obtained, although some of the prime contractors object to the additional paper work.

**By E. L.  
Warner, Jr.**

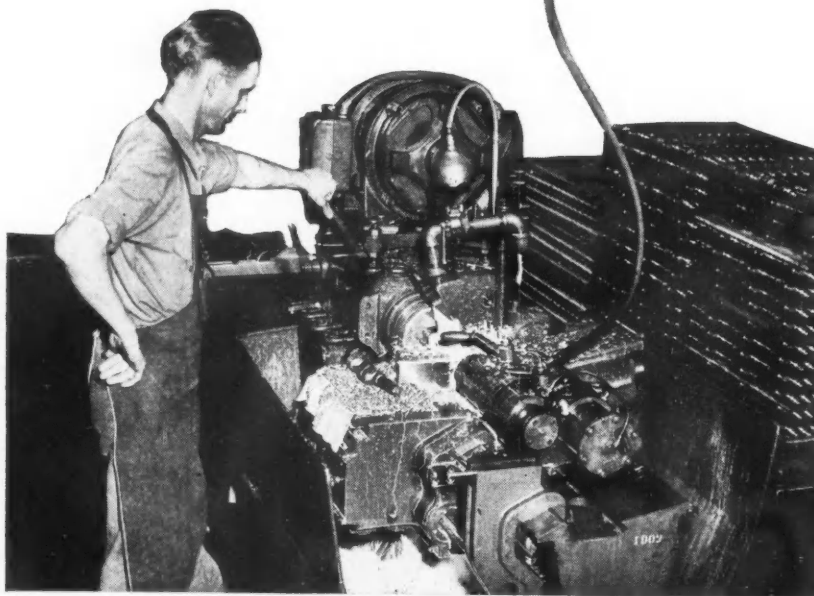
WPB has placed tighter restrictions on the delivery of surplus stocks of anti-friction bearings, General Preference Order E-10 having been amended to that effect on Nov. 10. Such surplus bearings may be re-delivered to the persons from whom they were obtained, if acceptable, or they may be disposed of to fill any order rated AAA or any order rated AA-5 or higher placed by the Army, Navy, Maritime Commission or War Shipping Administration. The base rating on deliveries of anti-friction bearings is raised to AA-5, but with the proviso that orders placed prior to November 10 may be delivered on a rating of A-10 or higher.

Each bearing maker also is required to schedule his total anti-friction bearing production on a quarterly basis beginning Jan. 1. During each quarterly period 85 per cent of production is to be for delivery against production orders and 15 per cent against miscellaneous orders. However, a producer may vary these percentages if he does not have enough unfilled orders and estimated future orders reasonably anticipated to be received within the next 90 days to absorb one or the other of the percentage allocations.

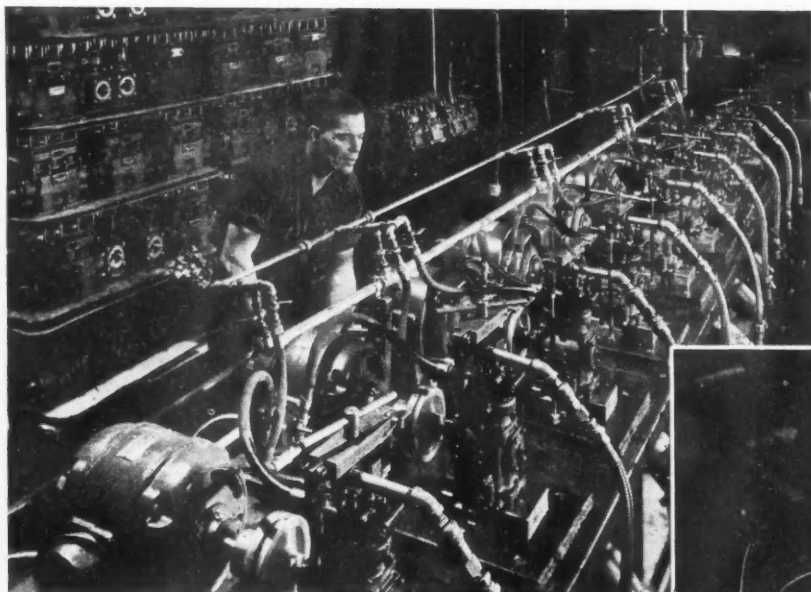
But why all the emphasis on bearings? This is a war of machines and every machine requires a variety of bearings, both as original equipment and as replacements. The total bearing demand probably is three or four times the industry's pre-war output. A light tank requires 86 bearings and a medium tank 120 bearings. The latter also uses 150 steel balls for turret rotation. The U. S. has produced more than 56,000 tanks and tank destroyers since the defense program began in May, 1940. An Allison aircraft engine of the type used in the P-38 takes 74 ball bearings and a Pratt & Whitney engine, such as those installed in the B-24 bomber, requires 38 ball bearings. Rocker arms, crankshafts, wrist pins, magnetos and superchargers all require ball or roller bearings. Up to Sept. 1, U. S. plants had turned out 349,000 airplane

*(Turn to page 87, please)*

## Bendix-Westinghouse Plant Organized to Produce a



(Above) Here is a closeup of one of the two Lo-Swing lathes which head up the crankshaft machine line. The cranks are rough-turned at this station.



(Above) Compressors coming off the assembly line must pass inspection on these production testing benches, where they go through cycles simulating the most severe field operating conditions.

(Right) Kent-Owens hand miller is employed for milling the hex head on special cap nuts shown at the right.



**“THEY** gotta roll—before they march, fly, or sail.”

That's the wartime slogan of the Bendix-Westinghouse Automotive Air Brake Co. And it is literally true that military vehicles and trucks and buses and mobile gun units needs must rely upon powerful dependable brakes for their performance, and their ability to deliver vital war materiel to the right place at the right time.

Bendix-Westinghouse is known to the industry as the source for automotive air brakes for heavy duty transportation equipment whatever be its character. But essentially, Bendix-Westinghouse is a specialist in harnessing pneumatic power to the needs of industry and transportation. Today this activity extends to the manufacture not only of air brakes but of the following equipment as well: air clutch controls, air steering, air gear shift, reversing mechanism for Diesel marine engine drives, independent trailer controls, air supply systems, and air horns. In addition, the company recently embarked on the manufacture of the Eaves Sound Projector, designed and marketed through the Eaves Sound Projector Division.

The new plant in Ohio, to which



# Variety of **Pneumatic Power** Equipment

By **Joseph Geschelin**

this company moved from its original home in Pittsburgh only two years ago, consists of two buildings, the smaller unit of the two having been erected after the move was made. Owing to a comprehensive system of subcontracting, many of the small parts and screw machine parts are made outside. But most of the major parts are produced here and all are assembled into the line of compressors, cylinders, control valves, slack adjusters, etc.

Another contribution of vital importance to the motorized equipment of the Army is

## Factory Routing Cylinder Block

OPERATION	EQUIPMENT
Mill top and bottom.....	Cincinnati Duplex mill
Rough bore cylinders to 2.014.	Natco B225H 801
Mill (2) end bosses.....	Kent-Owens Mill
Mill center boss .....	Kent-Owens Mill
Drill countersink .....	Natco
Drill and countersink (2) holes in center boss.....	Delta drill
Drill 5/8 in. holes in ends.....	Delta drill
Drill 5/7 in. hole center boss..	Delta drill
Face and counterbore center boss for welch plug.....	Cincinnati-Bickford
Drill 1/4 in. inlet holes in one cylinder .....	Delta drill
Drill 1/4 in. inlet holes in other cylinder .....	Delta drill
Tap (6) 5/16—18 holes in top..	Procurier tapping machine
Tap (4) 1/4 in. holes in ends...	Delta drill
Tap (2) 1/4 in. holes, center boss .....	Delta drill
Wash .....	Washer
Finish bore .....	Ex-Cell-O precision boring machine
Blow out chips .....	Bench

*This is the Eighty-eighth in the series of monthly production features*

the Portable Air Supply unit, a compact self-driven system for providing air to inflate tires, for operating pneumatic grease guns, for inflating rubber boats, and for operating various kinds of repair tools in maintenance depots. This unit is something that holds possibilities of post-war uses resulting from the war time experience.

Obviously the improvement of products now in use as well as the development of new and advanced applications of air depends largely upon fundamental research. To this end the company operates an extensive development and research department

which runs on a 24-hour schedule. Due to the war, its efforts have been bent not only to the development of new



*(Above) Interesting view of two-spindle Heald Bore-Matic in the connecting rod department. The big end as well as the bushing in the small end are diamond-bored in this set-up.*



*(Left) An imposing battery of Greenlee automatic screw machine provides this decorative setting in the new screw machine department.*

products but to a comprehensive search for non-critical or less critical materials in the interest of conservation. This has had fruition in the materials that now goes into the current line of products.

Many items of special life testing equipment are constantly in operation in this department. Here, for example, is a machine for subjecting pneumatic controls, brake valves, etc., to millions of operating cycles under simulated service conditions. Compressors are tested on electrically driven test racks equipped with independent lubricating and water-cooling systems as well as automatic protection devices. These racks have variable speed control to permit operating speeds ranging from 600 to 3600 rpm. Brake valve operation is studied on a special stand providing instrumentation for recording every aspect of its functioning. Another test stand is equipped for recording readings of air transmission time. Generally speaking, the research department is fully prepared for the development program in this important field of activity.

Coming to the plant itself, we find a thoroughly modern manufacturing establishment completely air conditioned throughout, with excellent fluorescent lighting and provided with the latest types of production equipment. From a management standpoint, the layout has been departmentalized in the interest of

flexible operation. Here are self-contained departments for the production of a variety of connecting rods, for the gamut of crankshafts, for cylinder blocks and heads, for slack adjusters, etc. A large area is devoted to the assembly of the various items in the line.

Typical of the machinery found here are such items as—Greenlee automatics, Conomatics of various sizes, National Acme-Gridley automatics, Brown & Sharpe automatics, Barber-Colman hobbing machines, Excell-O precision boring machines, Heald precision boring machines, Natco drills, Delta drills, Landis hydraulic grinders, Cincinnati mills, Cincinnati Duplex Hydromatic mills, Kearney & Trecker mills, Cincinnati Centerless grinders, Lo-Swing Model LR

(Right) Fastenings of brake chamber assemblies are made up automatically and at high speed on this Detroit Power Screw Driver unit.

(Below) Bliss hydraulic press—one of the largest pieces of equipment in the B-W plant—turns out deep-drawn stampings for flanges, diaphragms, and cylinders.



## Factory Routing Connecting Rod and Cap

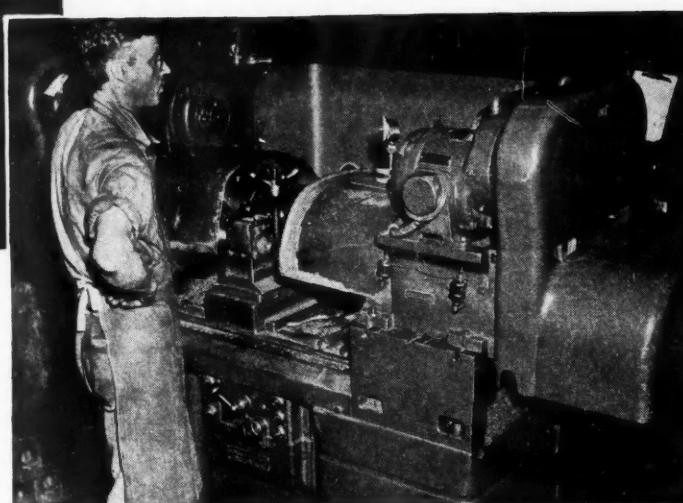
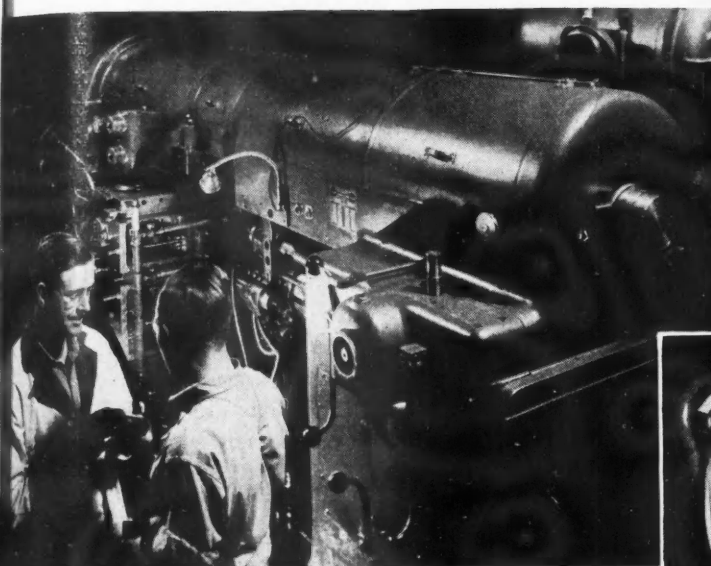
OPERATION	EQUIPMENT
Coin to 0.820-0.826 .....	#666 Bliss press
Grind sides 0.813-0.001.....	Blanchard grinder
Drill, ream and chamfer.....	Natco 3AL
Chamfer 5/8 in. holes (to burr)....	Delta drill
Mill crankpin end of rod (2 at once) and center punch.....	Sundstrand mill
Degrease .....	Heat treat
Tin and Babbitt and face.....	Babbitt
Clean excess Babbitt, wire brush and hammer .....	Wire brush and bench
Drill (2) 19/64 in. bolt holes, ream 0.314 and burr .....	Delta drill
Saw cap from rod.....	Campbell Abrasive Cutoff saw
Drill 3/16 in. on hole and burr...	Leland-Gifford drill
Assemble cap to rod and set nuts	
Press in bronze bushing.....	
Clean face of rod.....	Leland-Gifford drill
Rough bore .....	Delta drill
Bore and face radius on crank shaft bore .....	Heald Bore-Matic
Face radius on other side.....	Cincinnati-Bickford drill
Finish press in bushing, clean off surplus .....	
Babbitt, blow out chips and burr complete .....	

(Right) Versatile Andrew C. Campbell abrasive cut-off machine in the crankshaft department doubles in brass by cutting crankshafts to length; also sawing the cap off connecting rod forgings.

(Below) One of a battery of huge Conomatics in the screw machine department. This one is set up for mass production of spring cages for high pressure valves.



(Below) Precision-boring of crankcase is handled on this massive two-spindle Ex-Cell-O boring machine, using diamond tools.



## Factory Routing Crankshaft

### OPERATION

### EQUIPMENT

Grind ends flat for center.....	Wheel
Center .....	Whilton
	Ex-Cell-O
Turn short end bearing to 1.195 in., turn O.D. of throws to 1.112 in. R—chamfer—check long and short ends, turn long ends bearing to 1.195 in.....	Lo-Swing Model LR Lathe
Turn straight to 0.952 in. dia...	Lo-Swing Model LR Lathe
Turn ½ in. thread to size.....	LeBlond lathe
Turn 1 pin .....	LeBlond lathe
Repeat on other pin.....	LeBlond lathe
Turn oil throw pin.....	LeBlond lathe
Turn taper .....	LeBlond lathe
Neck and chamfer ½ in. dia....	LeBlond lathe
Grind end bearings and shoulders .....	Landis grinder
Grind 1 5/15 in. dia. ....	Landis grinder
Grind ¾ dia. and radius.....	Landis grinder
Grind taper .....	Landis grinder
Center and face .....	\$4 Warner & Swasey turret lathe
Drill (1) ¾ in. hole.....	
Drill (1) 31/64 in. hole.....	
Inside and outside chamfer....	
Bore to 0.5005—0.4995 .....	
Mill thread ½-20 .....	Hanson Whitney thread miller
Mill woodruff key .....	Kent-Owens Mill
Grind crankpins .....	Landis grinder
Spot for ½ in. hole & drill oil holes .....	Avey drill
Grind oil pin .....	Landis grinder
Drill oil hole in oil pin 1/16 in..	Avey drill
Drill cotter pin hole.....	Avey drill
Burr cotter pin hole.....	Avey drill
Burr complete .....	Bench
Wash oil and blow out.....	Bench

crankshaft lathes, Campbell abrasive cut-off machines, Barnesdrill honing machine with Micromatic hones, LaPointe horizontal broaching machines and many others. The Campbell abrasive cut-off machines are versatile in operation, handling not only the sawing of connecting rod caps, but the cutting to length of the gamut of crankshafts as well.

Then there is a heat treating and metal finishing department replete with suitable technical equipment. Here is a battery of Ajax salt-bath furnaces for heat treating various parts. Detrex alkali washers are used for cleaning before and after heat treating and prior to finishing. A compact installation is provided for the Granodizing of zinc base alloy die castings. The parts are first cleaned in a Detrex degreaser, then processed through the Granodizing tanks. In the same department is equipment for providing Pentrate treatment of certain parts.

An excellent toolroom serves the manufacturing departments. Among the equipment provided for these functions are—Kearney & Trecker mills, Pratt & Whitney precision toolroom lathes, Monarch lathes, a P & W jig borer, a Moore jig grinder with a high-

(Turn to page 62, please)



# Improvements in German

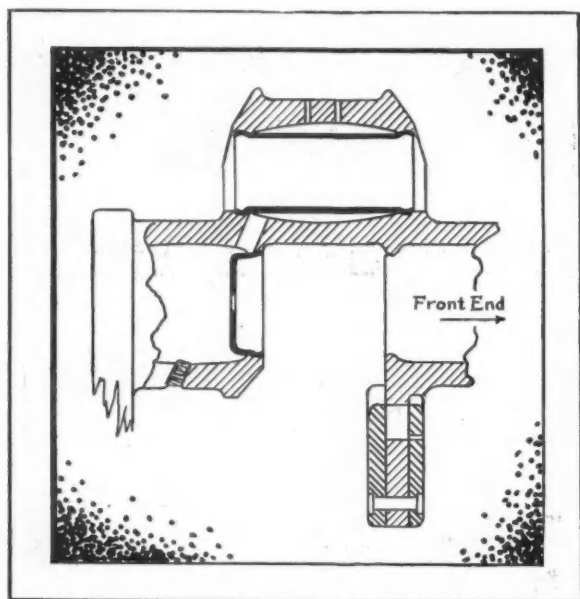


Fig. 1—Part section of crankshaft and balance weight

**L**ATE models of the Messerschmitt 109E and 109F fighters shot down in England are equipped with the DB-601N engine, a development of the DB-601A, which has been described in the June 15, and July 15, 1941 and Oct. 15, 1943 issues of *AUTOMOTIVE AND AVIATION INDUSTRIES*. Among the more important changes are an increase in the compression ratio and the addition of further automatic controls. The bore and stroke remain the same (5.90 by 6.30 in.), but the compression ratio has been increased from 6.9 to 7.9. This change was conveniently accomplished by replacing the original pistons with a slightly recessed crown by a new design with a flat top. The top land on the new piston is 0.060 in. wider, and the weight of the bare piston has been increased by 4 oz to 4 lb 3 oz.

Among other changes in design noted in the official Brit-

ish report are the following:

(a) The transverse oil grooves on the outer surface of the big-end three-row roller race are omitted, but two additional holes are drilled through the race.

(b) The main bearings of the crankshaft and the plain connecting-rod bearings have a tin coating 0.000025 in. thick over their copper-lead linings, doubtless to prevent pick-up during the running-in period.

(c) No oil holes are now drilled in the upper half shell of the main bearings. Center-punching to hold the lock screws of these halves has been discontinued, and they are now held by nuts and split pins sunk in the ends of the cap, as they were in the No. 4 bearing (the locating bearings) only in the 601A.

(d) Oil from the main bearing now passes to the adjacent crankpin through a hole in the crank arm, instead of through a small tube fixed in the bore of the journal (see Fig. 1).

(e) The plain-rod big-end bearing shells are moved circumferentially, so that the diametral joints are out of line, which probably stiffens the bearing as a whole and assists lubrication.

(f) The gear box connecting the pilot's throttle system with the override device to give extra boost for one minute is modified internally, but is not used. Thus there is now no automatic time limitation of the boost pressure at maximum altitude, and no enrichment at full throttle. Much of the linkage is still fitted, but not the time-limiting windmill device.

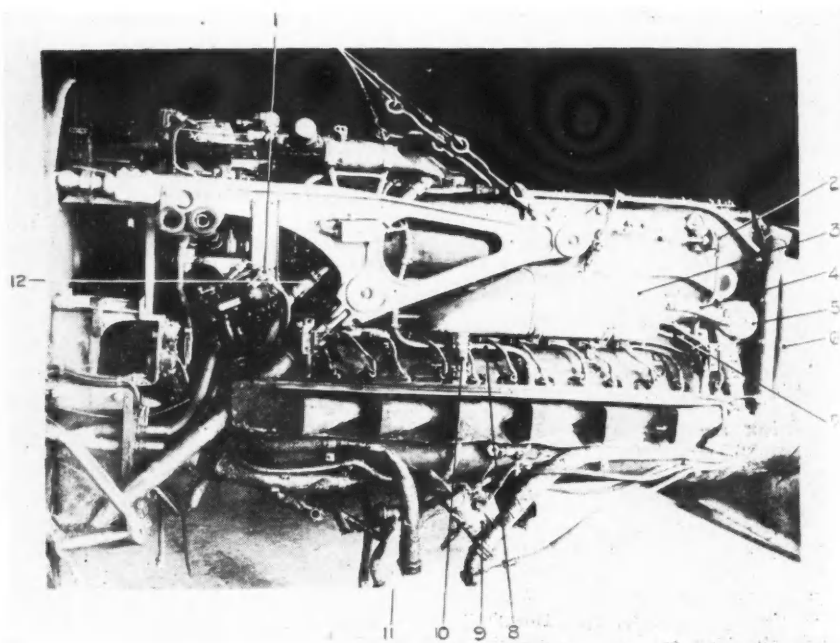


Fig. 2 — Starboard side of engine, showing coolant tank 3 and external swirl chamber 4

# DB-601 N Aircraft Engine

**By M. W. Bourdon**

Special Correspondent of  
AUTOMOTIVE and AVIATION  
INDUSTRIES in Great Britain

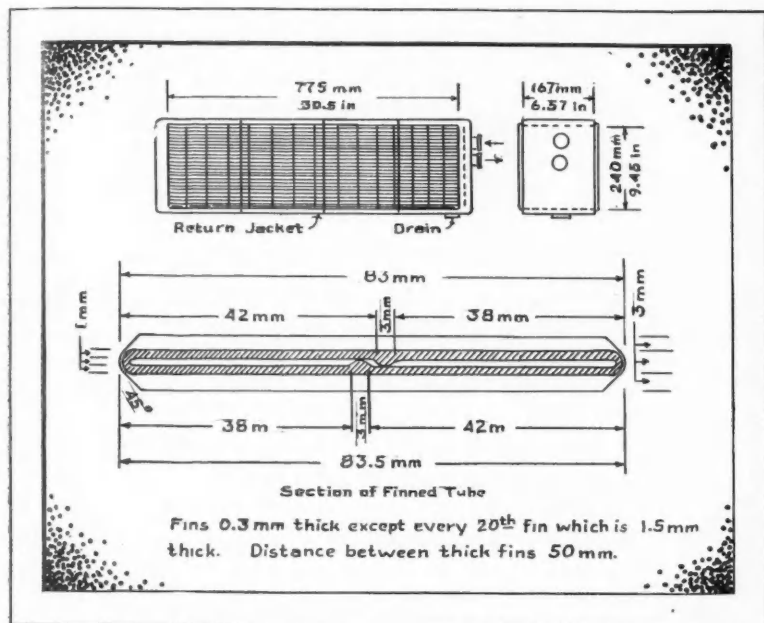


Fig. 3 — Details of the coolant radiator, made of flat aluminum tubes with integral fins

## Coolant System

The U-shaped coolant header tank formerly mounted around the reduction-gear casing has been replaced by two 5-quart tanks strapped to the sides of the crankcase. A balance pipe 3 (Fig. 2) of 3/16-in. bore connects the tops of the tanks, and a double-acting relief valve 2 is connected to the balance pipe. Coolant pumped through the cylinder jackets flows into the external vapor-separating swirl chamber 5, the vapor returning through pipes 4 to the tanks.

The new external swirl chamber is larger than that formerly built into the U-shaped header tank. Coolant leaving it passes through two pipes along the inboard side of the camshaft covers to a radiator in each wing. The return pipes from the radiator connect the bottom of the engine bulkhead in a junction piece, which houses a ther-

mostat control unit operating the radiator air flow control flaps by a servo using the hydraulic-system pressure. Coolant then flows to the pump inlet. Priming pipes 10 from the tanks join below the engine to a 7/8-in. pipe connected to the pump-inlet elbow.

A 50/50 glycol-water mixture is specified as the coolant.

The coolant radiators (Fig. 3) are of new design and worthy of note. They are constructed throughout of aluminum, with welded joints, and are of the finned-tube type. The fins are integral with the tubes, which are solid drawn or extruded in a rectangular section, with the fins formed by machining the thick tube. Two interior ridges along the center of each tube prevent collapse

during machining.

Each radiator is a single-flow unit formed of 24 horizontal rows of tubes, with two tubes in each row in the direction of the air flow, the ends of the tubes being expanded and welded together, which dispenses with tube plates. The side header boxes, bottom return passage, and top cover are welded on. Copper fin-and-tube-type radiators of standard German design

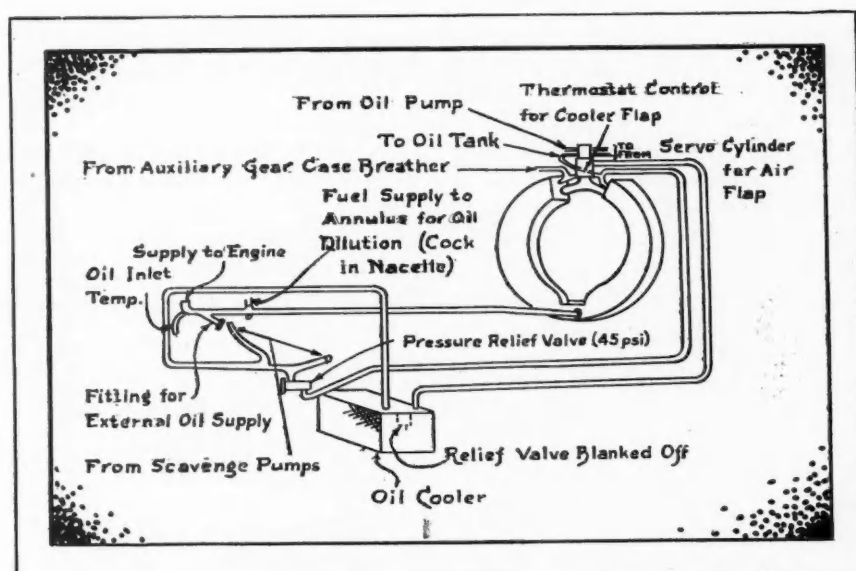


Fig. 4 — Diagram of Me 109 P1/2 lubrication system. The horseshoe-shaped oil tank encircles the reduction-gear casing

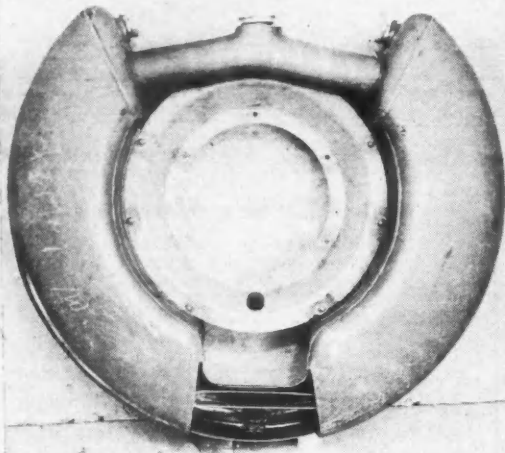


Fig. 5—Oil tank cut away at the bottom to show the fishtail-shaped outlet

were found on one Me 109F. They had a frontal area of 1.61 sq ft, which would give about 228 sq ft surface area. The dry weight of this radiator was 79 lb. The same test pressure was specified, viz., 0.0175 kg/cm<sup>2</sup> (0.25 psi).

#### New Oil Tank

Internal details of the lubrication system remain substantially the same, but the tankage and piping system has been modified as shown in Fig. 4. An oil tank of horseshoe shape (6 in Fig. 2), of about 10 gal capacity, takes the place previously occupied by the U-shaped coolant tank around the reduction-gear casing. Oil is drawn through a fishtail-shaped funnel outlet (see the cutaway view Fig. 5), welded inside the bottom of the tank, and through a pipe passing along the inboard side of the port camshaft cover, to the pressure-pump inlet. A oil-dilution spray annulus supplied with fuel under pressure through cock 1, Fig. 2, for operation by the ground staff is supplied for cold-weather starting, and a thermometer is fitted in the pressure-pump inlet elbow.

A scavenge pump in each camshaft cover delivers through

a common pipe to the cooler, with a relief valve set at 45 psi. The cooler weighs 50 lb and has a frontal area of 0.58 sq ft. It is mounted on the hinged and ducted lower cowling, together with the servo cylinder 9, Fig. 2, for flap operation.

#### Thermostat Control of Oil Cooler

The thermostat control unit of the oil cooler, shown in section in Fig. 6, consists of a brass case housing a bellows, screwed into a tank fitting where the scavenge oil enters the tank, with a spring-controlled piston valve controlling the oil flow to and from a servo motor cylinder linked to the cooler air flap. The brass case on one engine was found to contain impure n-butane between the case and bellows, with a boiling range of 31 F. to 39 F. The block carrying the oil pipe unions is stamped 75°C (167 F).

On similar thermostats in Heinkel planes, a compensating lever, pivoting on a bracket fixed to the brass case, moved by linkage with the air flap, has been fitted to butt on the top button stop as indicated in Fig. 6; but in the present Messerschmitt installation the lever is locked, thus holding the piston valve liner ports in a constant position relative to the bellows case.

This unit on the Me 109F therefore appears to be arranged to open the air flap at a pre-determined temperature of the lubricating oil entering the tank. Increase of oil temperature increases the vapor pressure of the trapped butane, causing the bellows and the heavy spring to be compressed, and the piston valve to be moved till the pressure supply (in this case from the main lubricating-oil system) is passed to the servo motor cylinder to open the air flap, the other side of the cylinder being open to drain. When

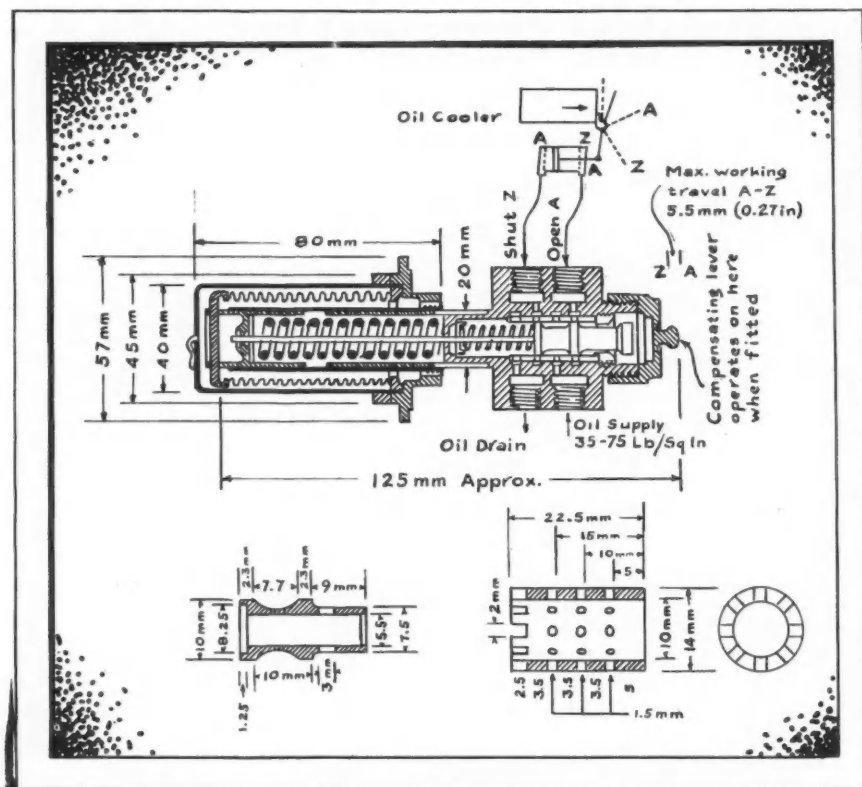


Fig. 6—Control thermostat of the servo for oil-cooler flaps of Me 109 F<sub>1/2</sub>



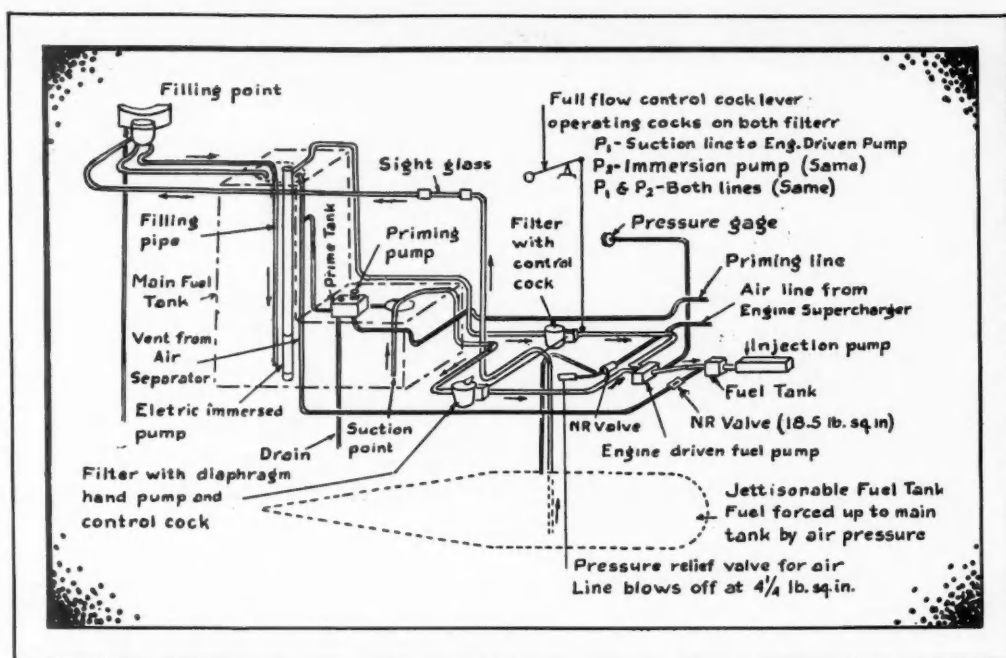
**Fig. 7—Diagram of the fuel system on Me 109E7**

the oil is cooled sufficiently, the reverse action occurs, but the flap will not remain in an intermediate position.

### Coolant-Temperature Control

The thermostat of the coolant-control system is generally similar to that of the oil system, but with an over-riding emergency hand control, actuated by pulling a handle in the cockpit. By this means the ports can be set to supply pressure to the servo of the radiator air flaps, to open the latter irrespective of temperature, or if the thermostat sticks. This over-riding control is spring-loaded, but it can be locked in the emergency position. Fluid from the hydraulic pressure system is supplied to this unit.

The fuel system of the Me 109 F  $\frac{1}{2}$  is on the same general lines as that of the 109E7 shown diagrammatically in Fig. 7, but it embodies several additional fittings, such as a vent pipe for the toe of the L-shaped main tank and a depth gage. Provision is made for a jettisonable reserve tank with individual filling point to be carried in a bomb rack below the fuselage. Fuel is transferred from this tank by supercharger discharge pressure so long as the latter can overcome the fuel head (approx. 4 ft). Connection from the supercharger discharge is through a lightly-loaded non-return valve, this valve, lifting at 4.25 psi gage, being fitted after the non-return valve. When all fuel has been transferred the reserve tank can be jettisoned by the bomb release gear, the air pressure and fuel discharge lines consisting of easily-fractured glass tubes. The fuel line then forms the main-tank vent.



An immersed, electrically-driven centrifugal fuel pump is fitted to boost one supply line to the engine-driven fuel pump if required; it is customary to use this when the fuel pressure drops below 11 psi. The priming system for starting has the usual separate fuel tank and pump in the cockpit.

The main fuel tank of the Me 109F  $\frac{1}{2}$  is made of self-sealing rubber with canvas reinforcement, but without the inner fibre casing that is a feature of the usual German tank of this type.

### Air Intake, Cowling and Exhaust Stubs

The air intake is an open 90 deg. L of round tubing in a welded-on fairing attached to the cowling, instead of the vaned type of intake formerly fitted. The engine cowling is in two main parts, divided by the exhaust stubs, the lower part being hinged on the starboard side and mounting the faired-in oil cooler and its servo motor, which are connected to the oil system by flexible pipes. The exhaust stubs, Fig. 21, are modified from the previous rectangular shape to round exit openings 1  $\frac{1}{4}$  in. wide. The mean length is 8  $\frac{7}{8}$  in. and the exit area, 4.04 sq in., the cylinder port area being 7.6 sq in. Each stub is swept back to about 30 deg. with the line of flight.

## Inertia-Scavenging and Uniflow Combined in Two-Stroke Engine

**T**HE principles of inertia-scavenging and uniflow operation are combined in a new Swedish two-stroke engine known as the Kylen, of which a diagram is shown herewith. (Page 92.) The engine has exhaust ports at the lower end of the stroke, and automatic transfer valves in the cylinder head. The crankcase is used as a scavenging pump, which fills the cylinder with charge when the engine is being started,

at which time there is no powerful exhaust and therefore no scavenging effect from the inertia of the exhaust column. When the engine runs at normal speed and carries considerable load, opening of the exhaust ports results in a quick evacuation of the burnt gases and the creation of a partial vacuum in the cylinder, and this is an aid to induction, resulting in a higher

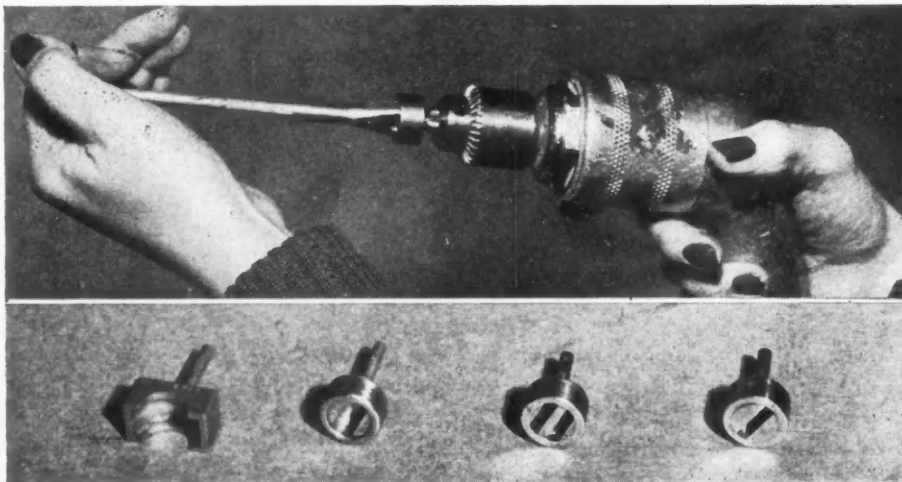
(Turn to page 92, please)



At the Goodyear Aircraft Corp. plant in Akron tables with inverted casters mounted in them are used to enable women operators to handle aluminum sheets with a minimum of effort. Top skins for Martin B-26 bomber wings are being fabricated at this Taylor Winfield spot welding machine.



Faster cleansing of material handling trays for small production parts is accomplished at Buick's bomber engine plant by providing a slot in one end of the trays so that disposable grease-proof paper may be inserted in the bottom to catch the dirt and grease. Bottoms of the trays become greasy before the partitions, hence the partitions were removable originally to permit easy cleaning of the trays. The removable separators were often lost or used for other purposes by the workmen. Twenty-four man-hours are saved daily by the new cleaning process. The number of small parts trays available for production needs has increased 50 per cent as a result of the new rehabilitation method.

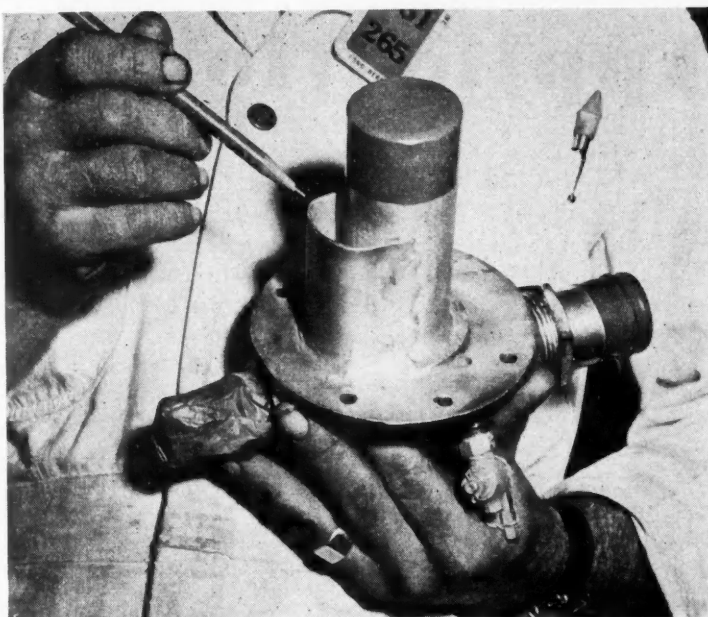


The attachment shown here is running a turnbuckle on a control cable fitting at the Vega Aircraft Corp. This device has effectively cut down a one to three minute hand operation to a twenty second automatic process.

Since there are literally dozens of similar "running" operations involved in the fabrication and assembly of modern aircraft, this attachment has been directly responsible for an appreciable decrease of man-hours on both Flying Fortresses and Venturas made at Vega. As may be seen in the insert, this inexpensive tool, designed by the Standard-Attachment Tooling Section of the Tool Engineering Department, can be adapted for running bearings, turnbuckles, or any type of threaded fitting quickly and efficiently.

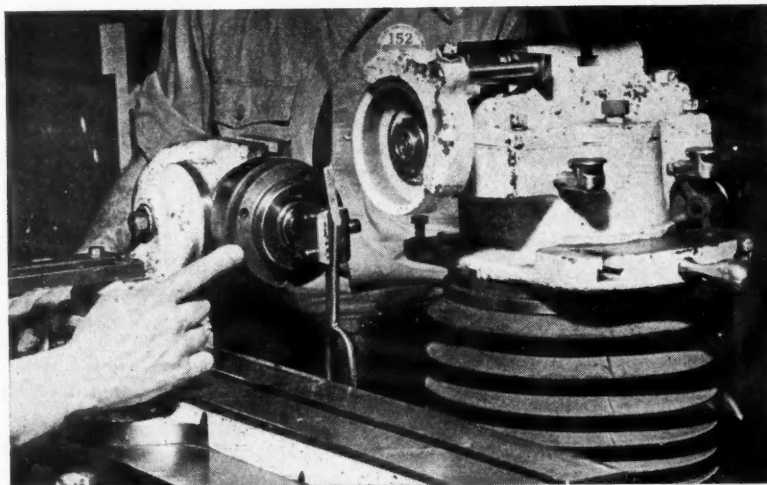
# Cuts

Due to water from condensation in the oil tank freezing in cold climates and clogging the lines to the engines with sludge, it was considered necessary to design a new casting so as to raise the level of the outlet above any sludge in the bottom of the tank. But a suggestion at the Douglas El Segundo plant to braze a stand pipe to the casting and weld boss for water drain pipe saved several thousand man-hours, thus reducing the cost and total elapsed time of an airplane modification.



In trying to find ways to speed up the test given each tank engine at the Chrysler plant as each operator had considerable paper work to do and precise calculations to make, John Barr, general foreman of the tank engine inspection, developed this machine to make calculations for them. As the picture reveals, the machine is homemade. It cost \$15. By turning the knobs and setting pointers, here is what it does: gives the ratios of the barometric pressure and air temperature to those of standard conditions, translates the engine rpm and dynamometer brake load into brake horsepower, and on it can be computed the fuel consumption per bhp-hr.

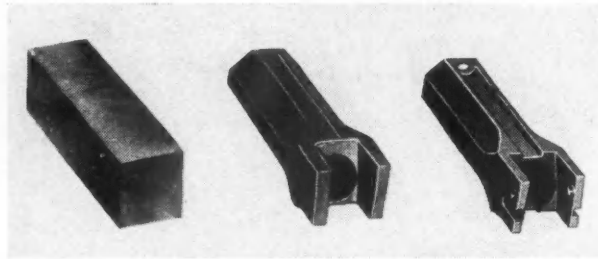
This universal sharpening attachment for tool grinding machines was developed at the Santa Monica plant of the Douglas Aircraft Co. and has resulted in better grinding of shears, scissors and single blade cutting tools as well as an increase of 50 per cent in the life of the tools. It also made possible the elimination of hand grinding by inexperienced workers.





# Applications of ArmaSteel

**A**T THE outset of the war program, when steel and other materials were becoming very scarce, the Saginaw Malleable Iron Division in cooperation with A. C. Spark Plug Division and members of Army Ordnance found it possible to replace with ArmaSteel certain types of forgings and bar stock, thus relieving an acute bottleneck situation, both in



**Oil Buffer Body on .50 Caliber Machine Guns**

*Weight of bar stock formerly used, 9 lb.; ArmaSteel rough casting, 4.3 lb.; machined part 2 lb. Metal saving per part, 4.7 lb.*

materials and in fabrication facilities. The open-minded attitude of Ordnance personnel had much to do with the successful introduction of "pearlitic malleable iron" in machine guns and other Ordnance items, with the result that ArmaSteel, successfully produced some years before Pearl Harbor, began to go into munitions of war before the Japanese attack. Since that time it has helped to solve shortages of steel and other critical metals to such an extent that nearly 12,000,000 castings have been used on machine guns, carbines, rifles, and other guns in addition to several million castings used in other war material. The savings thus effected in gun manufacture alone include not only some 33,000,000 pounds of steel and kindred critical material, but proportionately large sums of money which otherwise would have been expended in machining costs.

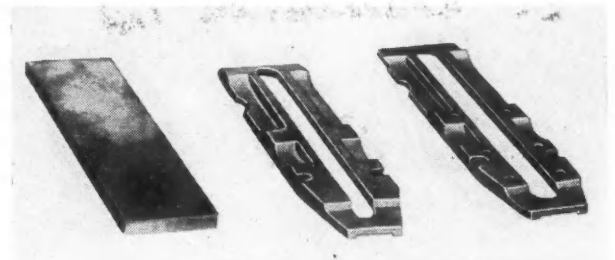
ArmaSteel is a cast ferrous metal having high yield strength, excellent wear resistance, and adaptability to selective hardening. It was developed after a long period of research by the Saginaw Malleable Iron Division and the General Motors Research Laboratories, and can also be described as "graphitic steel" or "pearlitic malleable iron." The grain structure is brought about by extremely careful control of both casting and annealing processes which results in the desired amount of combined carbon in the matrix and gives the metal uniform physical properties comparing favorably with those of medium carbon steel forgings and bar stock of the 1035-1050 range.

Such physical characteristics, combined with the fact that ArmaSteel can be cast close to the finished shape of various parts, were bound to make an impression upon engineers, even during peacetime years. When war production began to mount, ArmaSteel was therefore well-known in many quarters, with the result its substitution for other materials and processes has given rise to the large production of castings mentioned above.

The fact that ArmaSteel would respond to localized hardening made it valuable to peacetime producers of flame- or induction-hardened gears, transmission shifter yokes, and camshafts, for the resulting surface hardness produced maximum resistance to wear. It follows naturally that many gun parts in the current production program are being made of ArmaSteel selective hardened at the points exposed to excessive friction.

The flame-hardening method is accomplished with either oxygen and acetylene or natural gas and air. Partial immersion in a salt bath can also be used, followed by an oil or water quench. By installing the surface hardening equipment in the machining production line, material handling costs can be substantially reduced.

Austempering is another specialized form of heat treatment that has been developed to obtain increased hardness while retaining greater toughness than is



**Retracting Slide Bracket on .50 Caliber Machine Guns**

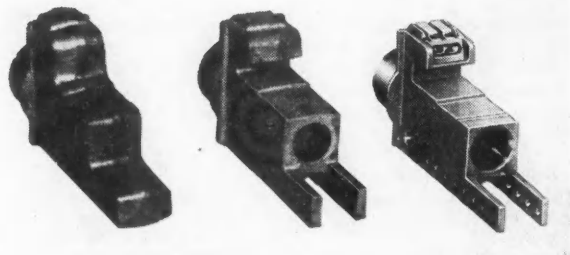
*Weight of bar stock formerly used, 4½ lb.; ArmaSteel rough casting, 2.6 lb.; machined part, 1½ lb. Saving per part—metal, 1.9 lb.; man-hours, 25 to 30 per cent reduction; cost, \$0.73.*

possible with flame or induction hardening. It was pioneered by the Brown-Lipe-Chapin and the A. C. Spark Plug Division of General Motors, who carried on an extensive experimentation with particular reference to the Accelerator for the .50 cal. machine gun, a part subject to considerable shock. The part is austempered by heating to 1550 F., holding for 30

# in War Products

**By J. H. Smith**

General Manager,  
Saginaw Malleable Iron Div.,  
General Motors Corp.



**Trunnion Block on .50 Caliber  
Machine Guns**

*Weight of forging formerly used, 20 lb.;  
ArmaSteel rough casting, 9.9 lb.; machined  
part, 6 lb. Saving per part—metal, 10.1 lb.;  
man-hours, 35 per cent reduction, approx. 2*

minutes and quenching in a salt bath at 550-600 F., held for 30 minutes, then quenching in water. The sorbitic-pearlitic structure of the material is thus changed to bainite, which is a tougher structure than can be obtained by the customary methods of hardening.

The successful use of ArmaSteel components in the .50 cal. Browning machine gun built by A. C. Spark Plug Division led to adoption of pearlitic malleable by nearly all manufacturers of machine guns, car lines, automatic rifles, and aircraft cannon. Of the total output of ArmaSteel today—approximately 1600 tons per month—about 1000 tons go into parts destined for use on these Ordnance items. Since experience has shown that it would have taken 40 per cent more material to make these parts of critical material, it follows that ArmaSteel alone saves approximately 1400 tons per month of critical steel and bronze for some other war job. Examples of the savings accomplished by using ArmaSteel in certain machine guns are as follows:

On the "Heavy Barrel" model .50 cal. machine gun, steel has been replaced in 23 components:

Weight of steel formerly used	85.3 lbs.
Weight of ArmaSteel parts	48.3 lbs.

Saving in metal not necessary to machine off 37. lbs.

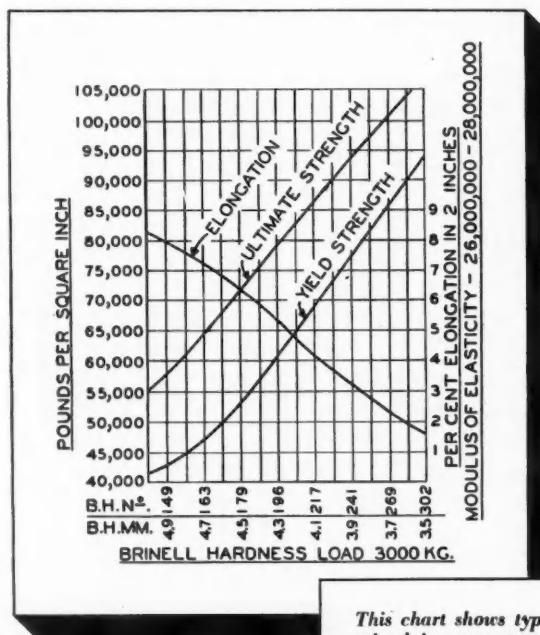
On the "Aircraft Basic" model .50 cal. machine gun, 22 steel components have been replaced:

Weight of steel parts formerly used	65.1 lbs.
Weight of ArmaSteel parts	42.7 lbs.

Savings in metal not necessary to machine off 22.4 lbs.

ArmaSteel has also played an important savings role in other types of Ordnance material, the Receiver in the .30 cal. Browning automatic rifle being an example. In this case the Receiver was at first machined from a solid piece of bar steel weighing 25 pounds. As cast this piece weighs but 9 pounds, a saving of 15 pounds. Furthermore, the original machining time was 16 to 18 hours, whereas the machining of the ArmaSteel casting requires less than two hours.

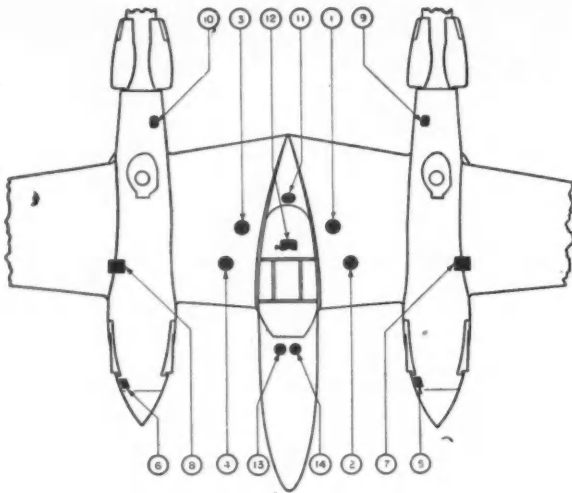
Similar savings might be listed in connection with the increasingly popular carbine, where the Trigger Housing on the M1 model and the Butt Plate on the M1A model are made of ArmaSteel. The Magazine Slide and the Sear Cover Plate on the 20 mm. aircraft cannon are also made of this material and are cast so closely to the contours of the finished parts as to reduce the metal to be machined off by almost 50 per cent.



*This chart shows typical results obtained in many tests of ArmaSteel, but they are not intended to be used as rigid specifications. For ordnance work ArmaSteel is made to the U. S. Army Ordnance Tentative Specification AXS-623, Revision 2, for pearlitic malleable iron castings, with minimum physical requirements as follows for Class A and B material:*

	Class A	Class B
Tensile Strength	75,000 psi	65,000 psi
Yield Strength	60,000 psi	50,000 psi
Elongation in 2 in.	2½%	4%
Brinell hardness range	197-241	163-207

# More Details of



## ← Location of fuel and coolant tanks

**1 and 3** Main fuel tanks—use 100 octane—Capacity normal 55 U. S. gallons—Overload 90 U. S. gal.

**2 and 4** Reserve fuel tanks—Use 100 octane—Capacity normal 60 U. S. gal.—Overload 60 U. S. gal.

**5 and 6** Engine coolant (panel 13)—Capacity 21 U. S. gal.

**7 and 8** Engine oil (Panel 15)—Capacity 13 U. S. gal.

**9 and 10** Supercharger oil (Panel 58)—Capacity 3 U. S. quarts.

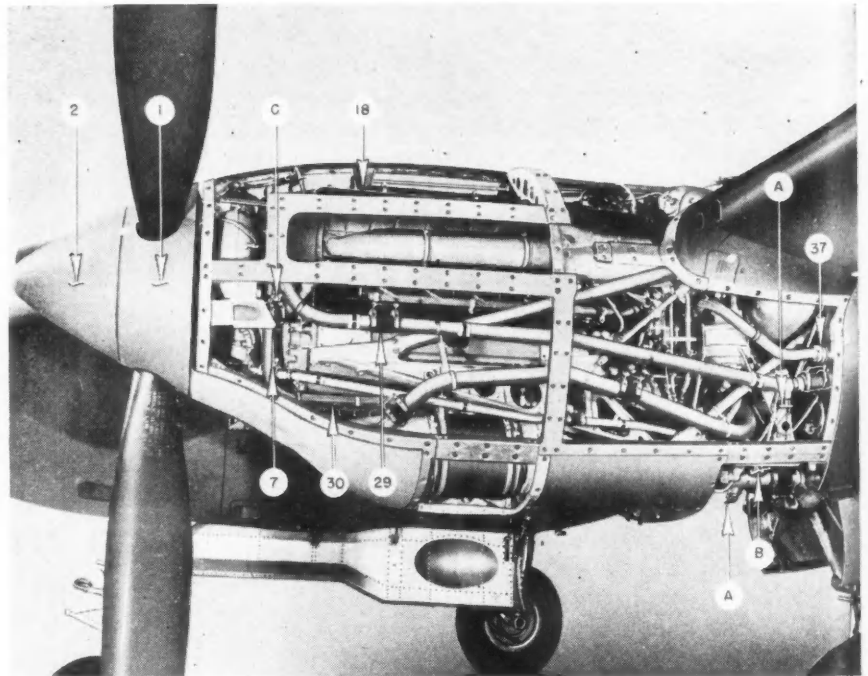
**11** Hydraulic reservoir (Panel 83)—Capacity 2.1 U. S. gal., System capacity approx. 8 U. S. gal.

**12** Emergency hydraulic oil tank capacity 1.4 U. S. gal.

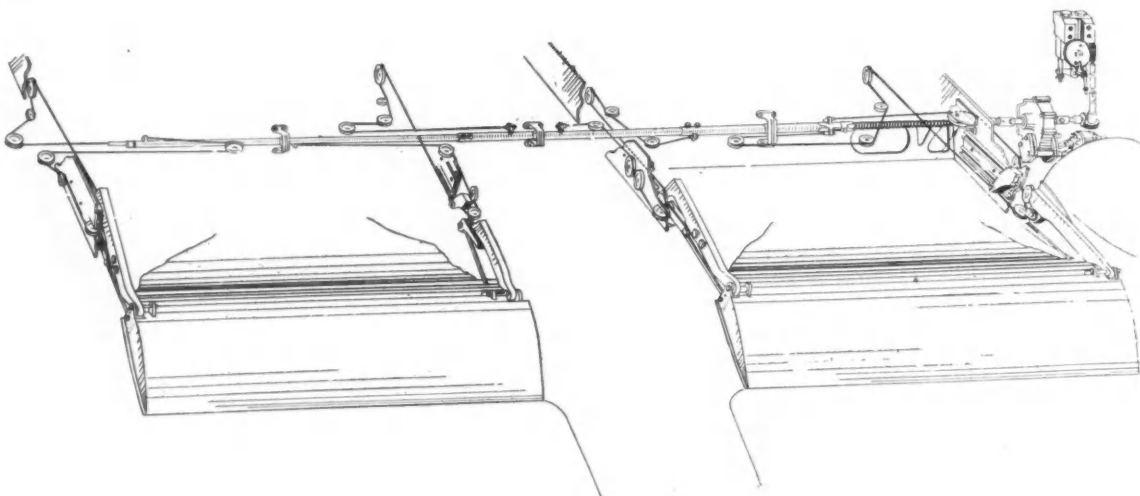
**13 and 14** Brake reservoir—Normal capacity 0.7 U. S. pt.—System capacity approx. 1 U. S. qt.

→  
**Side view of engine, cowl-  
ing removed. Circles and  
arrows indicate points of  
disconnection**

- 1. Propeller unit (Curtiss electrical)
- 2. Spinner
- 18. Propeller governor
- 7. Prestone line clamp
- A-A. Prestone drains
- B. Oil drain
- C. Spark plug blast tube
- 30. Oil line
- 29. Prestone line clamp
- 37. Electrical conduit plug



↓  
**Wing and center section  
flap installation**





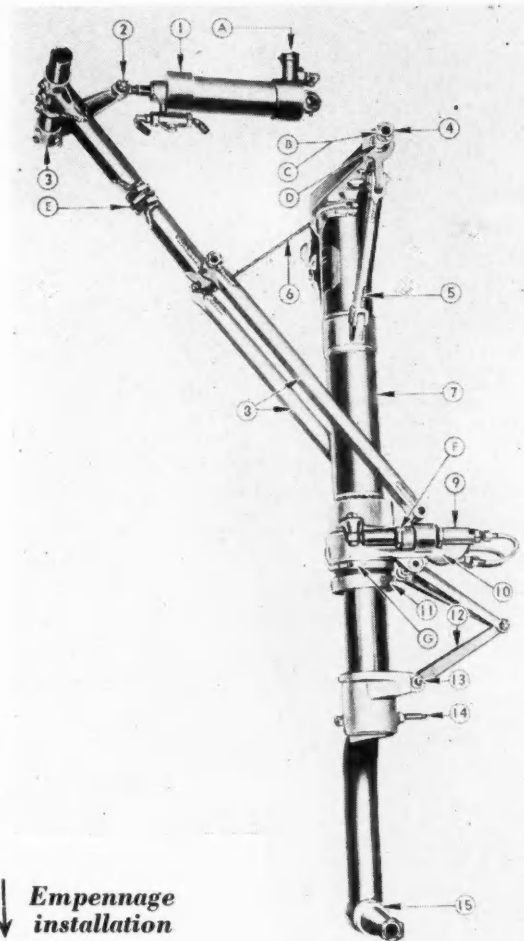
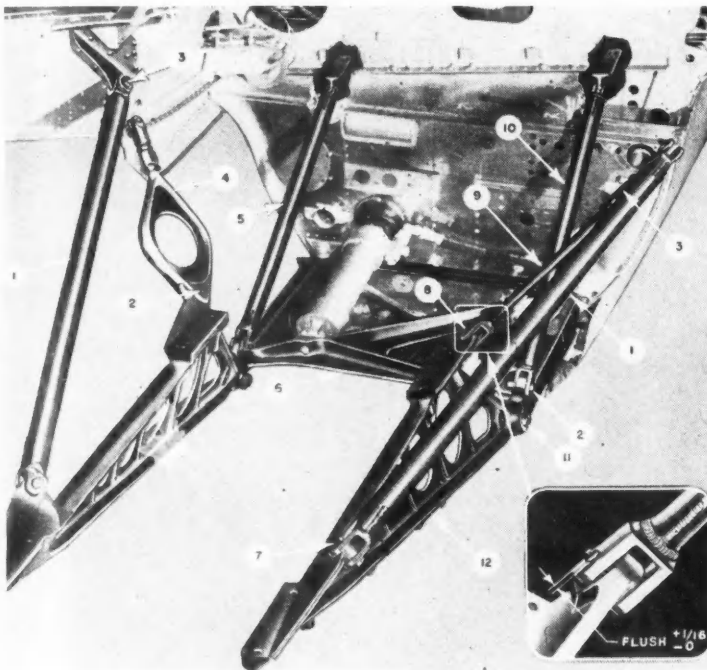
# the Lockheed P-38 Fighter

*Supplementing Article in November 1st Issue*

## Nose landing gear

- |                     |                              |
|---------------------|------------------------------|
| 1—Cylinder          | 12—Torque arm                |
| 2—Bolt-nut          | 13—Pin                       |
| 3—Torque lever      | 14—Eye bolt                  |
| 4—Pin               | 15—Spacer                    |
| 5—Side strut        | A—Downlock wedge             |
| 6—Chain             | B—Fulcrum pin nut            |
| 7—L. G. assembly    | C—Fulcrum pin nut            |
| 8—Drag struts       | D—Fulcrum pin puller         |
| 9—Cylinder assembly | E—Torque lever adjusting nut |
| 10—Tank assembly    | F—Cylinder lock nut          |
| 11—Gland nut        | G—Shimmy damper nut          |

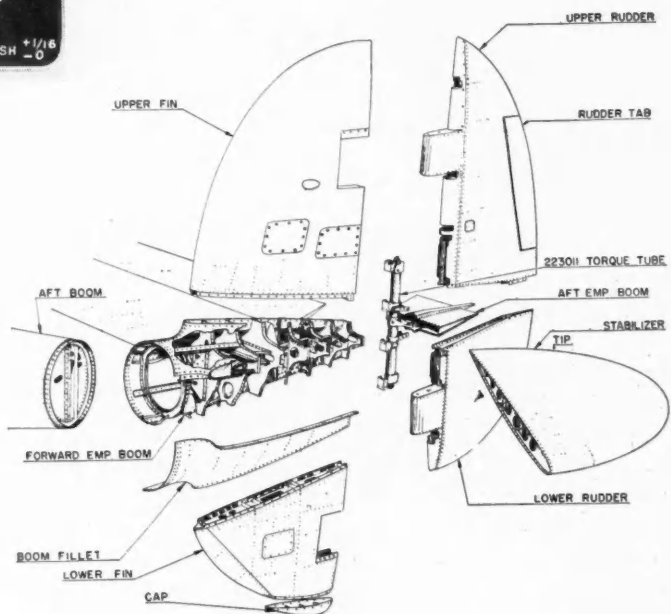
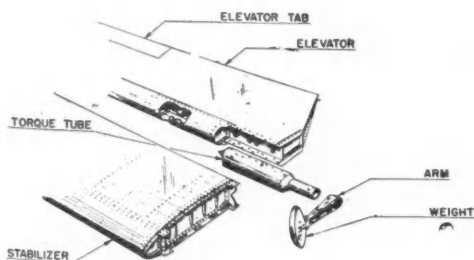
Additional views on the next page



↓ Empennage installation

## Engine mount and support assembly

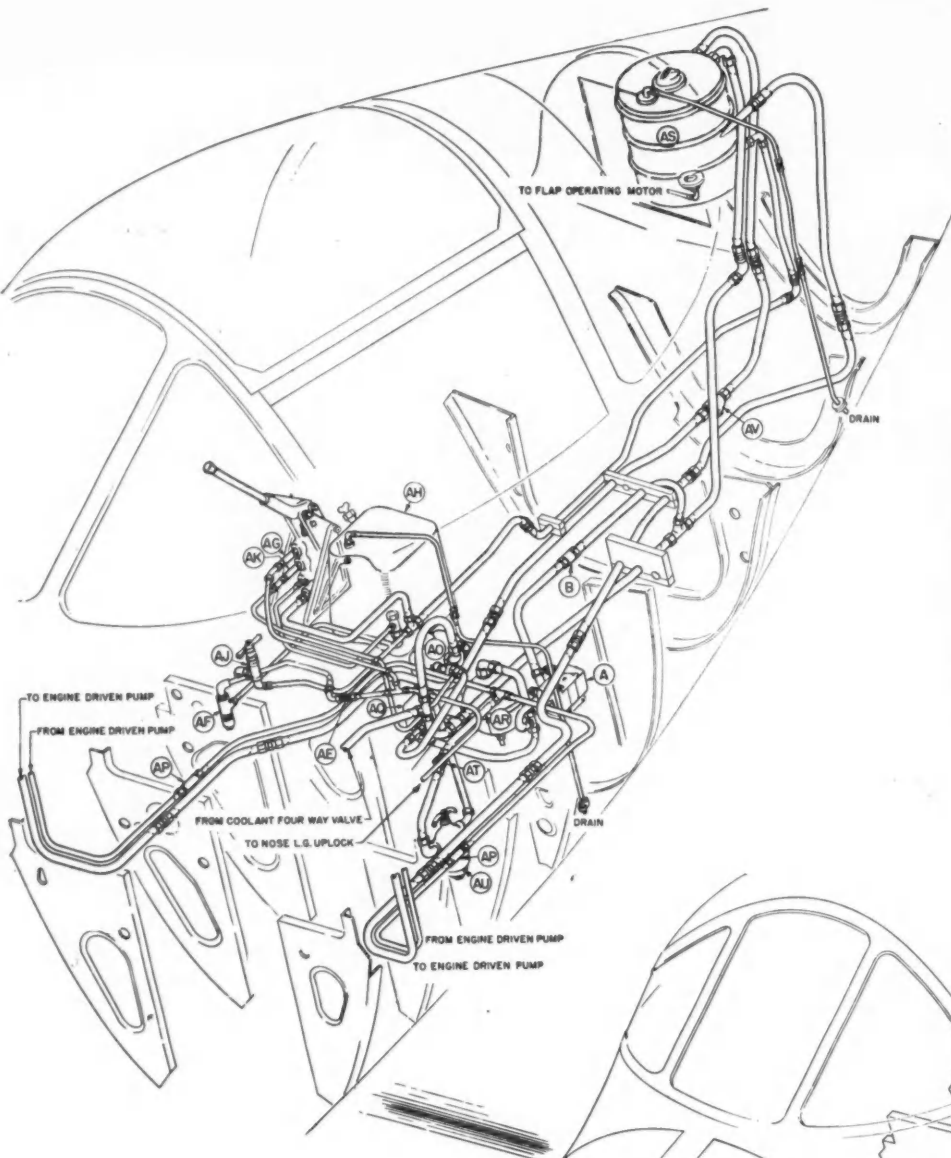
- |                 |                      |
|-----------------|----------------------|
| 1. Diagonal     | 8. Taper pin and nut |
| 2. Bolt and nut | 9. Diagonal          |
| 3. Bolt and nut | 10. Diagonal         |
| 4. Diagonal     | 11. Bolt and nut     |
| 5. Diagonal     | 12. Truss            |
| 6. Bay assembly |                      |
| 7. Bolt and nut |                      |



See the two preceding pages  
for more P-38 details

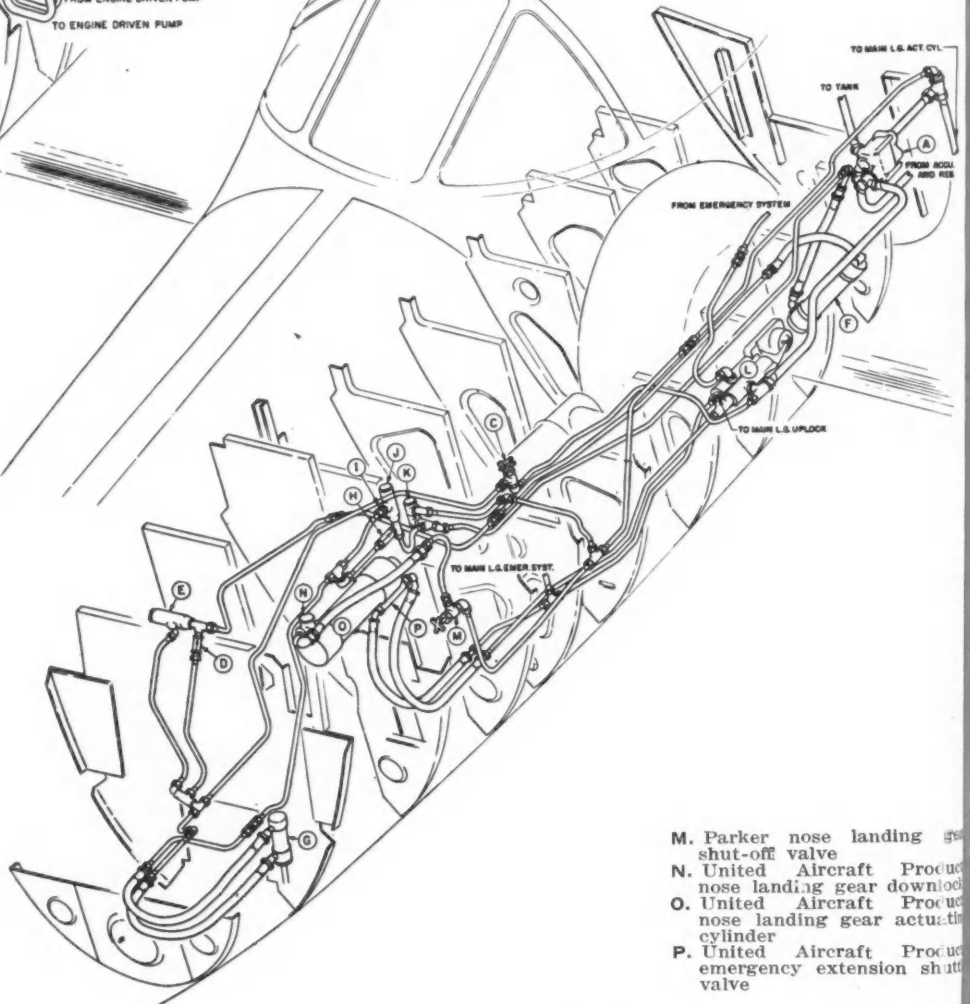
### Fuselage Basic Hydraulic Location Diagram

- A. Landing gear four-way valve
- B. Parker landing gear return check valve
- AF. Parker emergency system relief valve
- AH. Emergency system reservoir
- AI. Bendix emergency system hand pump
- AJ. Parker emergency system bypass valve
- AO. Flap four-way valve
- AP. Parker engine pump check valve
- AQ. Vickers main system pressure regulator
- AR. Vickers hydraulic accumulator
- AT. Parker pressure test check valve
- AU. Purolator main system hydraulic filter
- AV. Parker suction ground test valve
- AE. Bendix emergency system check valve
- AG. Parker emergency system check valve
- AK. Parker hand pump check valve
- AS. Reservoir



### Nose Landing Gear Hydraulic Location Diagram

- A. Aircraft Accessories Corp. landing gear four-way valve
- C. Parker nose door shut-off valve
- D. Parker nose door check valve
- E. Parker nose door relief valve —250 psi
- F. Vard nose door actuating cylinder
- G. Bendix nose door locking cylinder
- H. Parker nose door lock check valve
- I. Nose door lock restriction fitting
- J. Parker door lock relief valve —850 psi
- K. Bendix nose door control valve
- L. Bendix nose landing gear uplock



- M. Parker nose landing gear shut-off valve
- N. United Aircraft Product nose landing gear downlock
- O. United Aircraft Product nose landing gear actuating cylinder
- P. United Aircraft Product emergency extension shut-off valve

Morris armored car restarting  
on a test hill



**Morris**

**Armored**

## Car with Frameless Chassis

**By M. W. Bourdon**

Special Correspondent of  
AUTOMOTIVE and AVIATION  
INDUSTRIES in Great Britain

SEVERAL novel engineering features are found in the Morris armored reconnaissance car used by the British Army, one of which is the "frameless" construction, the welded armor-plate superstructure carrying the engine, suspension system, and other main components. The engine is at the rear, the drive from it incorporating an offset propeller shaft that "doubles-back" alongside the engine from the transfer case to a conventional type rear axle having a 5.1 to 1 gear ratio. To enable this arrangement of the drive to be embodied the engine is reversed, with the clutch and transmission at the front, approximately amidships.

The driving seat is centrally located with the steering column running forward in a driver's "tunnel" under the spade-shaped nose of the body. Forward vision is through a reinforced glass panel close to the driver's face, or through a slotted armor-plate flap enclosing the glass when in action. Aft of the driver, at a higher level, the gunner has a seat in a turret,

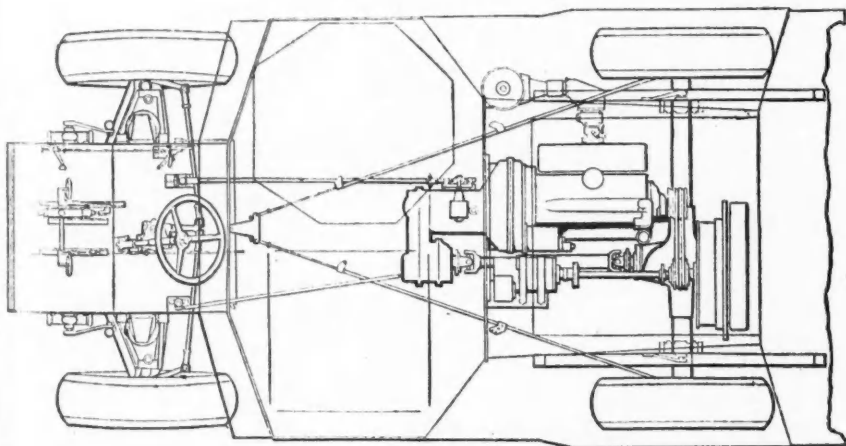
with the commander on his left. The latter's compartment has a roof made to open with two balanced panels, enabling him to stand for anti-aircraft and other observation duties. The rear encloses the engine, with access gained by raising two panels. The crew gains entry through a small door at either side or by dropping feet-first through the opening in the commander's roof.

The four-cylinder side valve engine has a bore and stroke of 3 15/16 by 4 3/4 in., the piston displacement being 231 cu in. The engine develops 72 bhp at 3000 rpm and the maximum speed of vehicle is about 50 mph. With the lowest of the eight gear ratios in use (46.4 to 1) gradients as steep as 40 per cent can be climbed. Fully armed and equipped with a Bren gun and anti-tank rifle the weight of the vehicle is around 7250 lb.

There is nothing unconventional about the engine, apart from the fact that the water-cooling system is a closed circuit and that the radiator at the rear has thermostatically controlled shutters over the lower part and an enclosed fan. The engine has an oil cooler. The clutch is the dry single-plate type, connected to a four-speed transmission, which has attached to the left of its front end a two-speed transfer case; hence eight speeds forward and two reverse.

Suspension is by conventional semi-elliptics at the rear and inde-

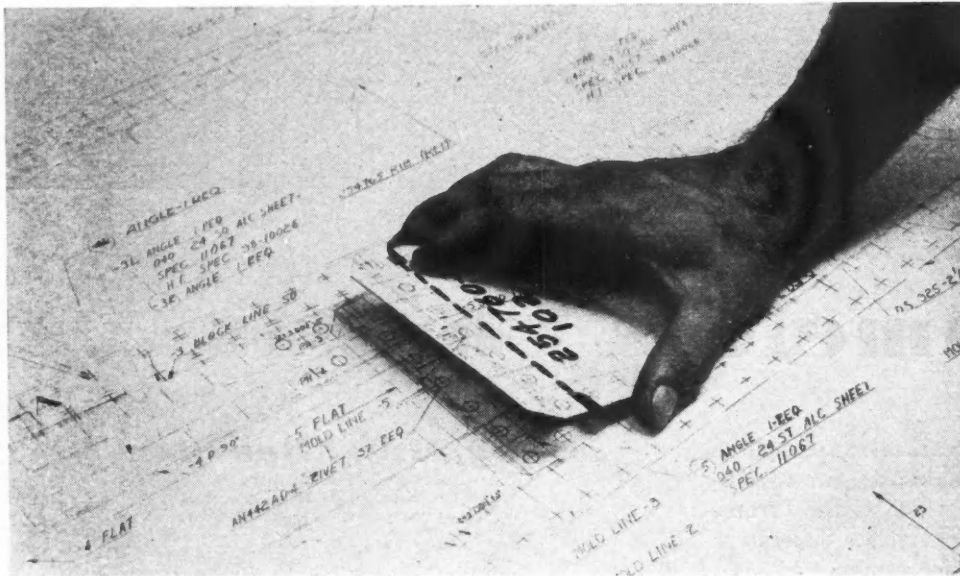
(Turn to page 77, please)



Plan view of the Morris armored car



# Reduction of Assembly



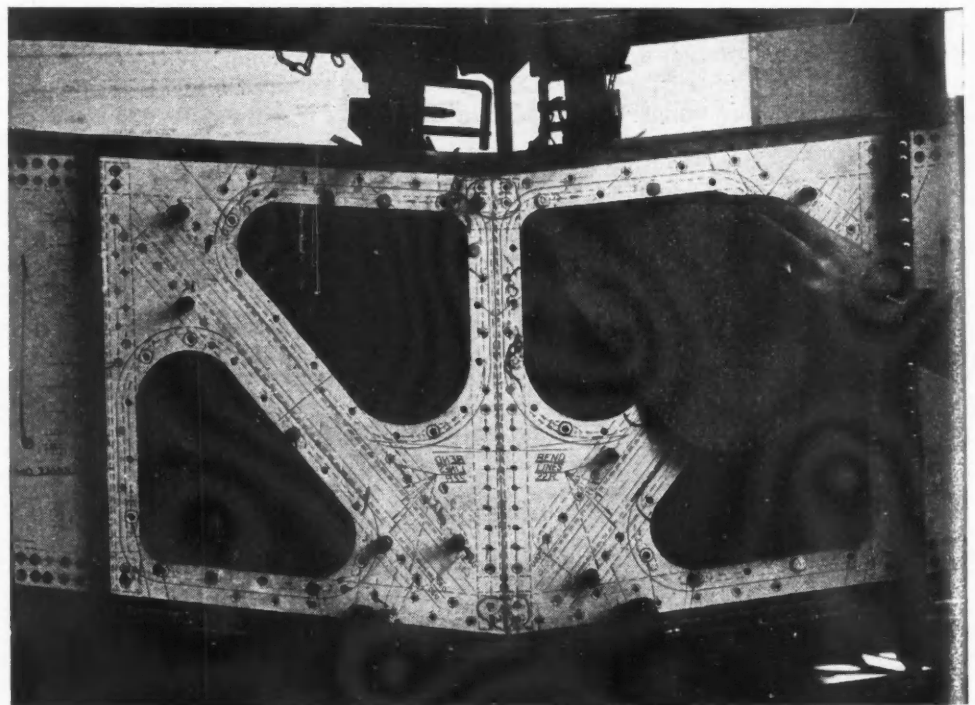
**Fig. 1. Inspecting Shop Template to Master DAT—Inspection of shop templates for production is done by comparing the cut and filed template outline with the master DAT. The presentation of design information and drafting methods are clearly shown.**

**L**AST January the Advisory Committee for Engineering of the West Coast War Production Council, appreciating the time lost in part fabrication and especially in assembly operations by minor inaccuracies in engineering drawings reproduced in or augmented by tooling, decided to create a pool of information on the subject of dimensional integrity. Each company prepared and distributed to each member of the Council a report giving the methods which its organization had adopted to assure maintenance of dimen-

The present article is essentially the report made by the Lockheed company. It went somewhat further than the original thought of the pool in that a discussion was given of design principles which had been found effective in reducing discrepancies and difficul-

sional integrity from conception of the engineer to the finished part or assembly. Many ideas were brought out and it was felt that this information pool constituted one of the constructive and valuable results of the Committee's work.

**Fig. 2. Use of DAT for Fabrication of Prototype Parts without Tools—The design of this spar web is symmetrical about the center line. This photo clearly shows that the design layout is for the right-hand side only. The left-hand side was reproduced from the right-hand layout by reversing the position of the DAT negative in the camera. Please notice the reversed lettering.**



# Time *through Maintenance of* *Dimensional Integrity in Production*

**By B. C. Boulton**

Administrative Engineer

**and**

**H. N. Harrison**

Chief Production Design Engineer,  
Lockheed Aircraft Corp.

ties in final assembly operations that often are the cause of much lost time and of such a nature that it is difficult to determine their cause.

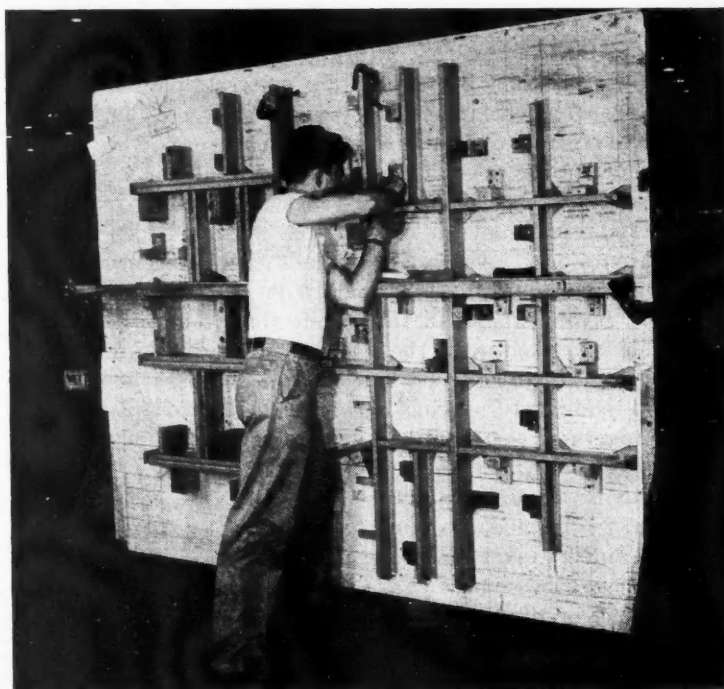
## **Dimensional Integrity**

Three years ago Lockheed took two basic steps aimed to secure and maintain during the manufacturing process dimensional integrity. The first step was to transfer the loft to the Engineering Department, both administratively and physically. At the time this was done, emphasis was laid on two points: First, eliminating the mystery from loft and template work. There had been built up what might be termed a psychological wall between the Loft and Template Department and Engineering which prevented an understanding by each group of the other's problems and methods. The terms used in lofting work were unfamiliar to the majority of our engineering personnel. Therefore, we prepared a carefully and simply written manual on loft and template work in which all the terms were carefully explained and illustrated and the general methods and principles explained.

The second point to which attention was given was the design of the loft floor. We felt it advisable to maintain a permanent record of contours prepared in the loft, and for this reason designed the loft floor so that it consisted of the requisite number of 4 ft by 12 ft sections of  $\frac{3}{8}$  in. plymetal. Through the use of an accurately constructed jig, these were drilled to permit interlocking and complete interchangeability. Through the use of the same jig, a grid of scribed lines 5 in. apart was placed on each left panel. This work was done so that an accuracy of  $\pm .005$  in. was maintained with no possibility for accumulated error. This loft floor was then placed upon a platform of relatively heavy construction, likewise made in sections but so arranged that no joints in the platform coincided with the joints in the loft floor proper, and there was no mechanical connections between the two. The arrangement permitted any size loft which was a multiple of the basic dimension of the loft floor panels to be used.

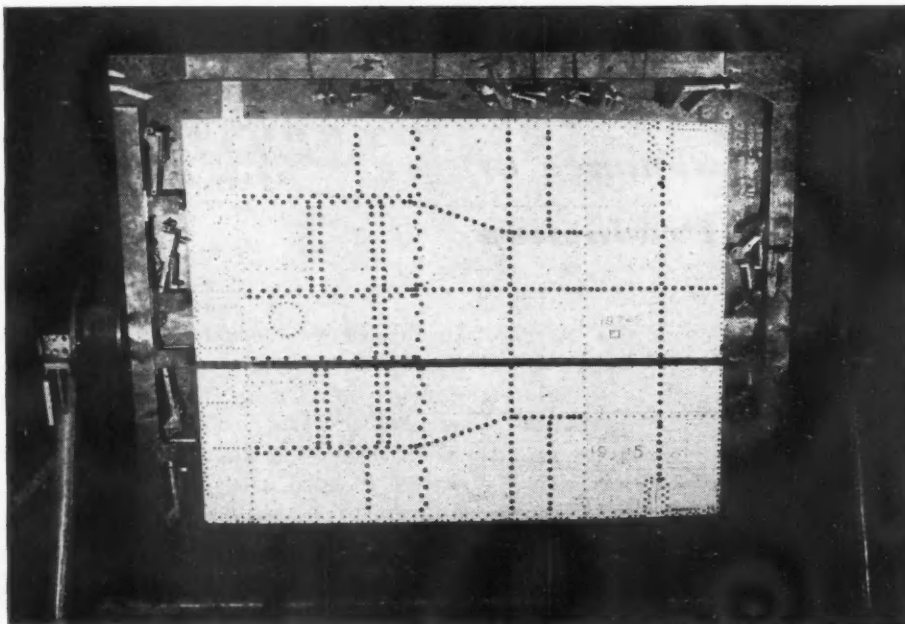
The next step in maintaining dimensional integrity was the practical elimination of half- or quarter-size paper drawings except for installations or main assemblies. For all structural sub-assemblies such as bulkheads, spars, and ribs, and for fillets, cowling and other similar parts, drawing (see Fig. 1) were made full-

size on carefully prepared steel plate; these being termed Detail Assembly Templates or DAT's. Likewise, all final layouts were made on similar metal sheets. We found that it was of considerable help to scribe on all such sheets, other than those for small drawings, the same 5 in. grid used for our loft floor; and, likewise, accurate to  $\pm 0.005$  in. We found that the psychology of drawing on metal full-scale was most conducive to accuracy, and there was an immediate



**Fig. 3. Parts Being Assembled in a DAT Type of Flat Assembly Jig—This photograph shows a DAT type of jig in use. Callout of parts on the DAT are of assistance in placing parts in their proper location in the jig.**

elimination of the many minor dimensional errors which had been a source of interference and annoyance in production. It may be noted that our standard tolerance for both loft and DAT drafting is  $\pm 0.010$  in., with critical dimensions laid out to an accuracy of  $\pm 0.007$  in., and a maximum tolerance for minor non-critical parts of  $\pm 0.012$  in. The Engineering Department has felt that an accuracy of  $.015$  in. was satisfactory, but the policy of our Tooling Department has been to obtain high accuracy and hence we have maintained and propose to maintain the above tolerances.



**Fig. 4. Production Assembly Drill Jig Made from DAT Reproduction** Hole locations on this drill jig were established by making the DAT an integral part of the jig and drilling through center lines of all rivet and bolt holes. This jig is designed for "floating" drill bushings. Shop layout time was saved by using a photo reproduction of the accurate design layout which was released as a DAT.

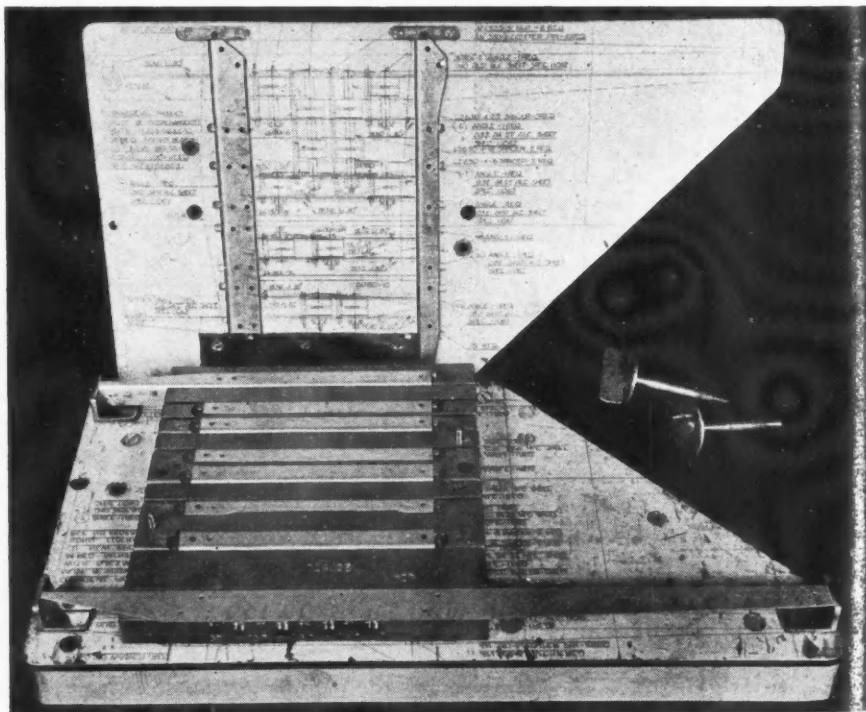
It is noted that in the pool information one company works to an accuracy of  $\pm 0.005$  in., whereas another company reports working to an accuracy of  $\pm 1/64$  in.

We have a group of "basic dimension checkers" who are responsible for calculating and checking all important dimensions. Our loftsmen are responsible for giving information from the loft and for putting necessary contours on DAT sheets, together with reference center lines so that this information is available for the detail layout work. In this connection it may be noted that the placing of the loft under Engineering gave a coordinated control which we did not have before and eliminated a considerable amount of lost motion, together with elimination of errors and inaccuracies resulting from the scaling of lofting contours and recording and transmission of such data to engineers in tubular form.

The above procedure gave basic control of dimensional integrity in the Engineering Department, and this control was extended into Tooling and hence into Production through the use of photographic reproductions from basic layouts and DAT's. As a result of experience covering a two-year period we have established a maximum acceptable tolerance on our photo-

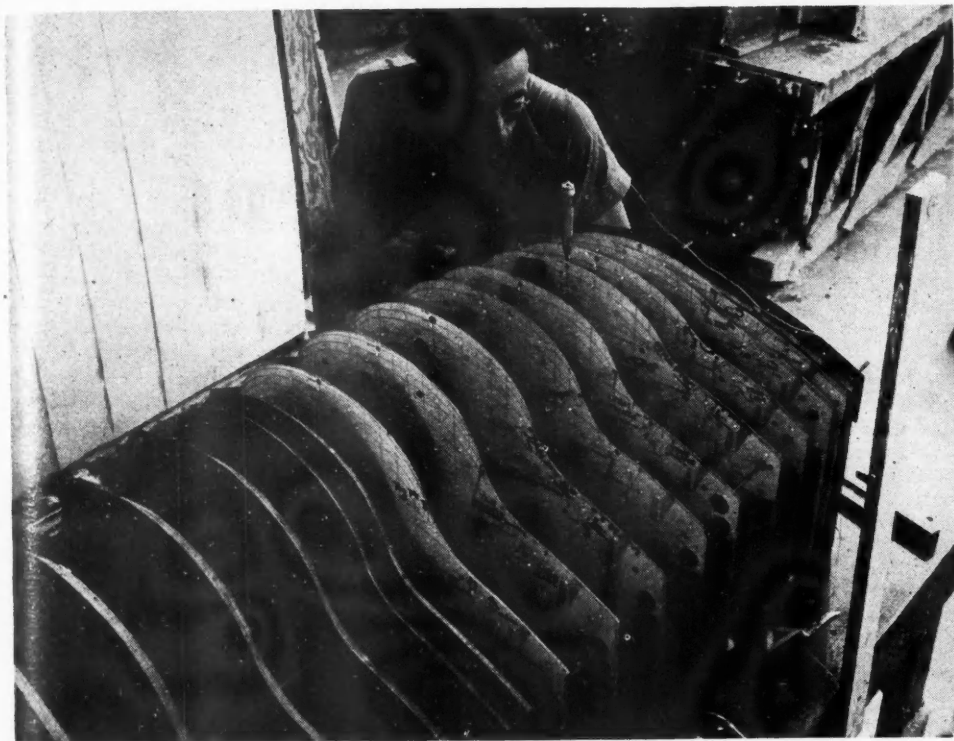
graphic reproductions of  $\pm 0.001$  in. per foot. Measurements to establish that this tolerance is met are readily made with the aid of the grid system used on DAT's. It is felt worth mentioning this tolerance because the accuracy maintained in Tooling is obviously limited by the accuracy of the DAT forming the basis of the tooling. There is

a considerable variation in the practice of different companies in this respect. We know from experience that the relatively close tolerance used can be secured without undue difficulty and with negligible rejections. One point might be noted in connection with obtaining dimensional integrity and securing ease of fabrication on experimental airplanes. This is our practice of reproducing a spar web (see Fig. 2) or bulkhead web directly on material that is to be used in the experimental airplane; that is, the proper gage of heat treated 24ST sheet, for example. All center lines and the complete rivet pattern are, of course, shown. We have for the last few months been working closely with our Production, Tooling, and Fabricating Depart-



**Fig. 5. Box Type Assembly Drill Jig—** This is a jig which permits the parts to be drilled in their assembled position, thus establishing coordination. It is to be noted that the faces of the upper and lower parts of the jig though the reverse of each other, are reproductions of one original, thereby insuring dimensional integrity.





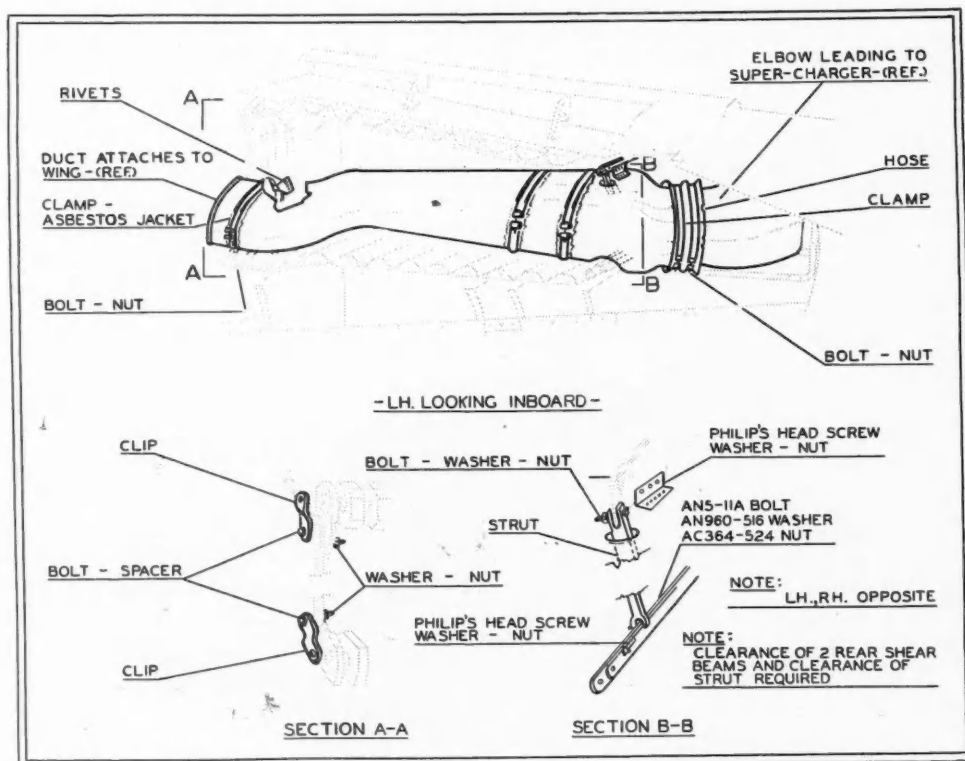
**Fig. 6. Plaster Mockup Contours Reproduced from Engineering Loft Lines by Photo and Prest Template Processes**—In this illustration both Prest templates (foreground) and Photo templates (background) have been used. By using both types the Photo process and the Prest process, time and expense can be saved which is not possible using either process alone. For example, plaster mockups to shrink scale can be made by expanding photographically the engineering mold lines layout to  $\frac{1}{8}$  in. or  $\frac{1}{10}$  in. per foot oversize. This oversize photo reproduction is then made into a Prest master from which station mold line templates are made.

ments to increase the number of uses (see Figs. 3, 4 and 5) to which template reproductions can be put, feeling that the full exploitation of them would result in further elimination of re-layout in the shop in the construction of flat assembly fixtures and drill jigs, thus saving both time and maintaining dimensional integrity. Fig. 6 illustrates the use of reproductions of contour layouts in the construction of a box template for a plaster mockup. Considerable difficulty may be experienced in securing full understanding and acceptance by production personnel of DAT's because of the change in character of information from conventional procedures although there has been little difficulty of this sort in the use of them in experimental construction. We found a number of points, the in-

corporation of which considerably improved our DAT's from the production viewpoint and facilitated their use. This section of the article deals with the large number of detail production troubles caused not by inaccuracies but by minor errors in engineering, particularly when paper drawings were used, or due to improper tooling or incorrect sequence of operations of fabrication. It has been necessary on either sub-assembly or final assembly to do "non-standard" hand work such as drilling, trimming, or filing. There is a tendency for such operations to continue because

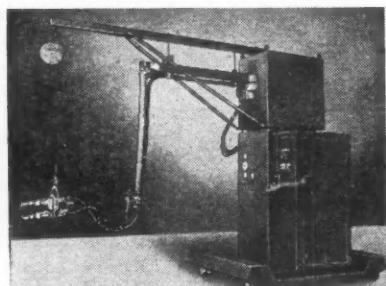
(Turn to page 69, please)

**Fig. 7. Installation of Intermediate Section of Air Duct to P-38 Supercharger**—This illustrates a condition which generally results in a misalignment of parts on assembly, since the duct is attached to each of two major assemblies. The right-hand support bracket for the section shown should be undrilled until after installation of complete duct and should allow for take-up.



# New Production Equipment

**C**ROWDED and fixed jigs can be easily reached with this radial-type gun spot welder, specially designed for aluminum and light alloys. Tacking operations as well as structural welding on large or fixed aluminum structures can be accomplished with greater speed and efficiency. Developed by Sciaky Bros., Chicago, Ill., this machine employs the stored energy principle and variable pressure cycle, Sciaky features which have been employed on standard press and rocker arm types. Known as type PS2R-1, this welder is rated at 100 kw. and has a capacity for aluminum of from two thicknesses of .016 in. up to .064 in.—corrosion resisting steels from two



*Sciaky radial-type gun spot welder*

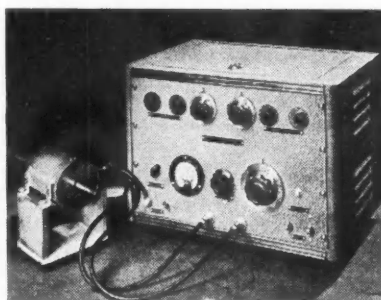
thicknesses of .016 in. up to .080 in. The cables are mounted to the gun on horizontal water-cooled copper bars of heavy section. These permit the use of light section cables to the gun, as electrical losses are reduced to a minimum. The flexible cables make the operation of the gun comparatively easy.

The control cabinet, main welding reactor, monorail and special copper bars connecting the gun to cables are all built as a self-contained unit. This unit is mounted on a stationary column and pivots on a vertical axis by means of ball bearings mounted inside the column. The unit can pivot 180 deg. and the machine area reached by the welding gun is represented by a half circle of 23 ft. in diameter. Transversal movement of the gun on a straight line can be 12 ft. in length and vertical movement 20 in. above and below a minimum position. The weight of the gun and cables is compensated for by a balancing device and the gun travels on the monorail over a length

of 3 ft. 4 in. Pressure as high as 1600 lbs. is supplied to the gun by means of a special air-operated hydraulic booster. A variety of horizontal and vertical gun types are available. The unit may be either stationary or buggy-mounted.

**A** HIGH-FREQUENCY electronic flaw detector for production-line detection of longitudinal cracks and seams in nonmagnetic metallic tubing in an extensive range of diameters and wall thicknesses has been announced by the General Electric Company, Schenectady, N. Y. The new instrument is capable of detecting and locating imperfections ½ in. long, 10 mils wide, and one-third of the wall thickness in depth, even though they are on the inside of the tubing and do not appear on either surface. It is especially desirable for testing tubing for coolers and heat exchangers before installation, thus preventing flaw failures in the field.

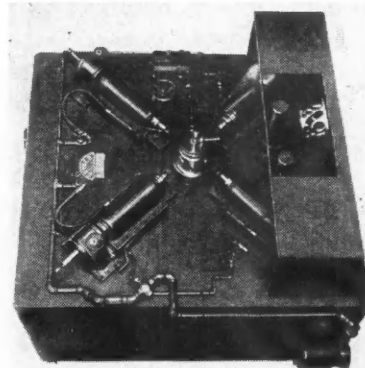
In the operation of the instrument the tubing to be tested is fed through a coil box whose coils are arranged in such a way that they surround the tubing. After the circuit constants for the particular size of tubing being tested are set by means of selector switches located on the panel of a control unit, power is applied to the coils which in turn induce eddy currents in the tubing. A flaw in the tubing causes changes in these eddy currents. An electronic circuit in the control unit detects these changes and energizes a signal relay, thus disclosing to the operator the existence and location of the flaw. The detector consists of a control unit, which is standard for testing various sizes of nonmagnetic tubing, and



*GE Electronic Tube Flaw Detector*

a coil box which accommodates any one specific size of round, straight tubing of uniform outside diameter from one-quarter to two inches, inclusive. Additional coil boxes, which are interchangeable as to mounting, dimensions, and cable terminals, are available to accommodate any size tubing within the dimensions specified. The power supply required for the electronic units is 100-125 volts, 60 cycles.

**S**NYDER TOOL & ENGINEERING Co., Detroit, Mich., has developed a special machine for finish milling four cam slots in aircraft propeller cams. It is equipped with four spindles to mill the four slots at one time. Spindles are mechanically inter-connected (each having its own hydraulic cylinder) and go through rapid approach and feed into the work in small steps while the work piece reciprocates and rotates in conformity to the master cam producing



*Snyder special hydraulic machine for milling slots in aircraft propeller cams*

the cam contour. The master cam is integrated with the mechanical motion of the fixture and is designed with a rise-to-length ratio of one in five, resulting in very smooth operation of the cam follower mechanism.

Spindles are driven from electric motors through v-belts and worm wheel drive and are mounted on precision tapered roller bearings, allowing take-up for possible wear. The amount of infeed on the tools per reciprocation of the part is adjustable over a wide range of .010 in. to .150 in. Infeed is hydraulic on automatic cycle operation. (Turn to page 94, please)

# Forecast of Motor Vehicle Registrations for 1943

By Marcus Ainsworth

IT is a tribute to the durability of American built motor vehicles and the efficiency of our automotive maintenance men that practically two years after motor vehicle production ceased, only 1,752,578 passenger cars and 176,819 trucks and buses will have been withdrawn from service during 1943 as shown by our annual estimate of total motor vehicle registrations for the year. Statisticians both within and without the automotive industry had predicted dire consequences to our private transportation system as a result of the cessation of motor vehicle production in the early months of 1942. They predicted a drop during 1942 of from 6 to 10 per cent in motor vehicle registrations and an increased decline in 1943 of from 10 per cent on up. However, registrations during 1942 showed a very moderate decline of only 4.6 per cent and the indications are

that 1943 will only be 6.0 per cent under the registrations of 1942.

These facts have been brought to light as a result of the annual forecast of total motor vehicle registrations conducted by AUTOMOTIVE AND AVIATION INDUSTRIES. Questionnaires are sent the motor vehicle commissioners of all states, on which we requested the actual registrations to the nearest available date and their estimate of the registrations for the remaining period of the year. Forty-five very complete returns were received which enables us to present the following forecast of motor vehicle registrations for 1943. It is interesting to note here that a similar forecast made in 1942 was underestimated from final figures by only seven-

tenths of 1 per cent or a total of 212,496 cars, trucks and buses.

During 1943 about 25,674,665 passenger cars will have been registered as compared with 27,427,243 during 1942, a decline of 1,752,578 units or 6.5 per cent. Trucks and buses combined indicate a very slight decline of 3.7 per cent, with 4,553,198 units that will be registered as against 4,730,017 in the preceding year. All motor vehicle registrations for 1943 will amount to 30,227,863 as compared with 32,157,260 during 1942, a decrease of 1,929,397 units or 6.0 per cent.

While registrations for the entire nation will have held up surprisingly well and beyond all expectations, it is remarkable when the veritable drought of gasoline in the 12 northeastern states and the District of Columbia is taken into consideration. This north-

(Turn to page 154, please)

## Estimated 1943 Motor Vehicle Registrations

	PASSENGER CARS			TRUCKS AND BUSES			TOTAL MOTOR VEHICLES		
	1943	1942	Per Cent Change	1943	1942	Per Cent Change	1943	1942	Per Cent Change
Alabama	283,000	300,259	- 5.6	65,500	66,849	- 2.0	348,500	367,103	- 5.0
Arizona	105,000	113,438	- 7.4	25,800	27,567	- 6.2	130,800	141,005	- 7.2
Arkansas	192,650	213,091	- 9.5	71,850	75,267	- 4.5	264,500	288,358	- 8.1
California (1)	2,458,514	2,378,731	+ 3.1	330,072	341,516	- 3.3	2,788,586	2,720,247	+ 2.5
Colorado (2)	254,068	331,478	-23.2	64,402	31,791	+102.5	318,470	363,269	-10.8
Connecticut	412,800	467,078	-11.7	55,300	58,672	- 5.5	468,100	525,750	-10.8
Delaware	54,000	55,765	- 4.8	13,100	13,416	- 2.5	67,100	69,181	- 2.9
District of Columbia	126,000	143,810	-12.2	18,000	16,935	+ 6.2	144,000	160,745	-10.2
Florida	400,000	422,800	- 5.2	89,000	85,535	+ 4.0	489,000	508,335	- 3.9
Georgia	419,156	444,732	- 5.5	98,713	100,538	- 1.3	517,869	545,270	- 5.0
Idaho	113,000	121,755	- 7.1	32,730	34,807	- 6.0	145,730	156,562	- 6.8
Illinois	1,608,615	1,748,253	- 8.0	223,480	233,386	- 4.2	1,832,095	1,981,639	- 7.5
Indiana	822,500	898,359	- 8.2	119,600	145,184	-19.2	942,100	1,043,543	- 9.7
Iowa	609,655	656,910	- 7.3	97,440	103,982	- 6.2	706,095	760,892	- 7.1
Kansas	485,000	505,754	- 4.0	119,000	119,725	- 0.6	604,000	625,479	- 3.4
Kentucky	364,000	394,294	- 5.3	74,000	73,539	- 0.6	438,000	467,833	- 6.2
Louisiana	333,450	335,576	- 0.7	73,000	74,522	- 2.0	406,450	410,098	- 0.9
Maine	145,950	157,630	- 7.3	49,025	42,514	+15.1	194,975	200,144	- 2.5
Maryland (1)	395,420	430,679	- 8.1	53,670	62,157	-14.0	449,090	492,836	- 9.0
Massachusetts	732,900	799,077	- 8.1	103,630	115,272	- 9.8	836,530	914,349	- 8.7
Michigan	1,171,051	1,196,154	- 2.0	131,291	131,597	+ 0.2	1,302,342	1,327,751	- 1.9
Minnesota	650,000	721,518	- 9.8	110,300	123,553	-10.9	760,300	845,071	-10.0
Mississippi	175,000	184,453	- 5.0	61,000	63,833	- 4.5	236,000	248,286	- 5.0
Missouri	739,000	794,846	- 6.8	143,000	159,342	- 9.8	882,000	954,188	- 7.0
Montana	114,500	123,636	- 7.0	44,500	49,635	-10.2	159,000	173,265	- 8.0
Nebraska	303,090	348,515	-12.5	63,651	70,615	-10.0	366,741	419,130	-12.0
Nevada	40,000	40,225	- 0.6	9,300	10,191	- 8.5	49,300	50,416	- 2.1
New Hampshire	87,000	98,716	-10.0	30,600	32,593	- 6.0	117,600	131,309	- 10.2
New Jersey	858,601	961,929	-10.7	135,000	143,933	- 6.0	993,601	1,105,862	- 9.0
New Mexico	77,650	86,073	- 9.6	27,656	29,843	- 7.2	105,306	115,916	- 9.0
New York	1,920,900	2,234,767	-15.0	304,850	361,994	-15.8	2,225,750	2,596,761	-15.2
North Carolina	495,000	531,234	- 6.8	97,000	97,693	- 0.7	592,000	628,927	- 5.7
North Dakota	136,060	142,148	- 4.4	42,830	42,039	+ 0.2	178,890	184,187	- 3.0
Ohio	1,792,495	1,866,278	- 4.0	189,710	196,466	- 3.1	1,982,205	2,062,744	- 3.0
Oklahoma	405,750	440,911	- 8.0	102,350	111,342	- 7.9	508,100	552,253	- 7.9
Oregon	331,196	341,367	- 2.8	75,852	76,199	- 0.5	407,048	417,566	- 2.4
Pennsylvania	1,724,501	1,879,439	- 8.2	283,733	282,299	+ 0.4	2,008,234	2,161,738	- 7.5
Rhode Island	161,724	168,954	- 4.2	21,236	22,495	- 5.7	182,960	191,449	- 4.4
South Carolina	280,000	295,211	- 5.0	55,000	50,039	+10.0	335,000	345,250	- 2.8
South Dakota	142,000	154,351	- 8.0	33,300	35,012	- 5.0	175,300	189,363	- 7.2
Tennessee	364,000	388,028	- 6.2	70,000	78,035	-10.2	434,000	466,063	- 7.0
Texas	1,275,000	1,316,479	- 3.1	294,800	299,030	- 1.3	1,569,800	1,615,509	- 2.9
Utah	134,850	123,440	+ 4.8	26,892	25,514	+ 5.0	161,742	148,954	+ 7.5
Vermont	71,000	77,749	- 8.6	10,150	9,997	+ 1.5	81,150	87,746	- 5.0
Virginia	422,500	449,837	- 6.0	83,850	84,541	- 0.8	506,350	534,378	- 5.0
Washington	498,000	514,662	- 3.0	97,500	95,847	+ 2.0	595,500	610,509	- 2.3
West Virginia	225,640	245,669	- 8.0	51,000	50,337	+ 1.3	276,640	296,006	- 6.5
Wisconsin	699,699	698,437	+ 1.6	137,355	145,631	- 5.5	837,054	844,068	- 0.8
Wyoming	63,800	66,712	- 4.2	20,200	20,192	None	84,000	86,904	- 3.2
Total	25,674,665	27,427,243	- 6.5	4,553,198	4,730,017	- 3.7	30,227,863	32,157,260	- 6.0

(1)—114,265 Light commercial vehicles registered as passenger cars have been transferred to trucks.

(2)—Large decrease in passenger cars and increase in trucks due to light commercial vehicles registered as passenger cars transferred to trucks for 1943.

Unable to make this transfer for 1942.



**I**T IS quite clear that operating air cargo transport efficiently and profitably presents a problem to be tackled by many for its ultimate solution. The plane makers alone cannot do it. Neither can the air lines, nor the shippers. Design operation, handling, loading and allied factors of air cargo are a common problem for many. The problem is complex—the variables numerous.

Then there also is the immediate problem of surplus military aircraft. Although some aircraft now in military use may lend themselves to more or less ready conversion to postwar commercial use, the potential possibilities of new designs must be considered before converting military planes to handle air cargo. Planes designed specifically for combat service will require extensive modification to convert them and heavy bombers may have a place in the air cargo picture, but with a sacrifice of efficiency.

Furthermore, the type of cargo to be carried by air is going to have a definite influence on the detail design of the cargo plane. As the potential air cargo market comprises for the most part perishables, goods requiring special handling, and goods of the high dollar value per pound, speed becomes a major selling point of air cargo. Packaging engineers also are constantly at work designing new forms of containers and shipping cases to reduce weight, but maintaining overall strength and protection.

Nobody can predict as yet just what role a helicopter is going to play in postwar air cargo. To date the helicopter apparently has been oversold by the press. There are many involved problems to overcome and the helicopter to many is looked upon as a good adjunct to the business air cargo.

The first point of coordination between air and surface cargo transportation is the airport. The usefulness of an individual airport for air cargo depends on the status of airports close by and of those hundreds or thousands of miles away.

And so, in a few terse statements one might sum up the thoughts left with those who attended the Air Cargo Engineering Meeting held in November by the Chicago Section of the Society of Automotive Engineers with the cooperation of the SAE Aircraft Activity. The banquet program featured William A. M. Burden, special aviation assistant to the Secretary of Commerce, who spoke on the development of the air cargo market. During the two-day sessions excellent technical papers were presented by engineers and officials from the air line and airplane manufacturing companies.

In his paper, "Some Economic Aspects of Commercial Use of Converted Military Aircraft," E. C. Wells, chief engineer of the Boeing Aircraft Co. stated that the political and military factors to be considered in the use of converted military equipment may outweigh the importance of the economics of their use. The transition of military aircraft production to peacetime production requires time and the converted airplane is the only solution if additional equipment is to be made available to operators during this period.

He went on to say that air cargo rates can be reduced appreciably from their present values by the use of con-

verted military transport equipment, but still further gains are possible for aircraft especially designed for the purpose. It must be realized that the airplane is a specialized piece of equipment and simply increasing operating weights will not produce magic. The fuselage will prove inadequate for greater payloads if a large part of the payload is used for passengers, though this limitation can be avoided to some degree in an all-cargo carrier.

### **By B. M. Ikert**

Mr. Wells stated the problem of adapting the military combat and cargo types to commercial use will be considerably greater than the problem of reconverting the former commercial transports. The military types tend to have relatively high wing loadings and compliance with the stalling speed requirements will affect the allowable operating weight for these types to a considerable greater degree than for the reconverted transport types. The necessity for major redesign of combat types involve a large expense and time delay. Since the converted airplanes can serve the airlines efficiently for only one or two years, any conversion is of major significance. The "battle scars" of bombers will necessitate elaborate inspection, repairs, and replacement before the airplanes would be fit for operation as public carriers. These costs as well as the cost of conversion of the fuselage, replacement of self sealing fuel tanks, etc., would have to be borne by the operator. Thus,

they could not, under the most optimistic conditions, approach the "no depreciation" costs shown for the reconverted transport types.

In conclusion Mr. Wells, made clear that a modern airplane specifically designed for economical operation, and incorporating design features and equipment dictated by the most up-to-date practice can compete on a cost basis with the reconverted transports; even when all depreciation expenses are eliminated, the cost of conversion is neglected, and no structural strength limitations are considered for the reconverted transports.

The amount of cargo that becomes

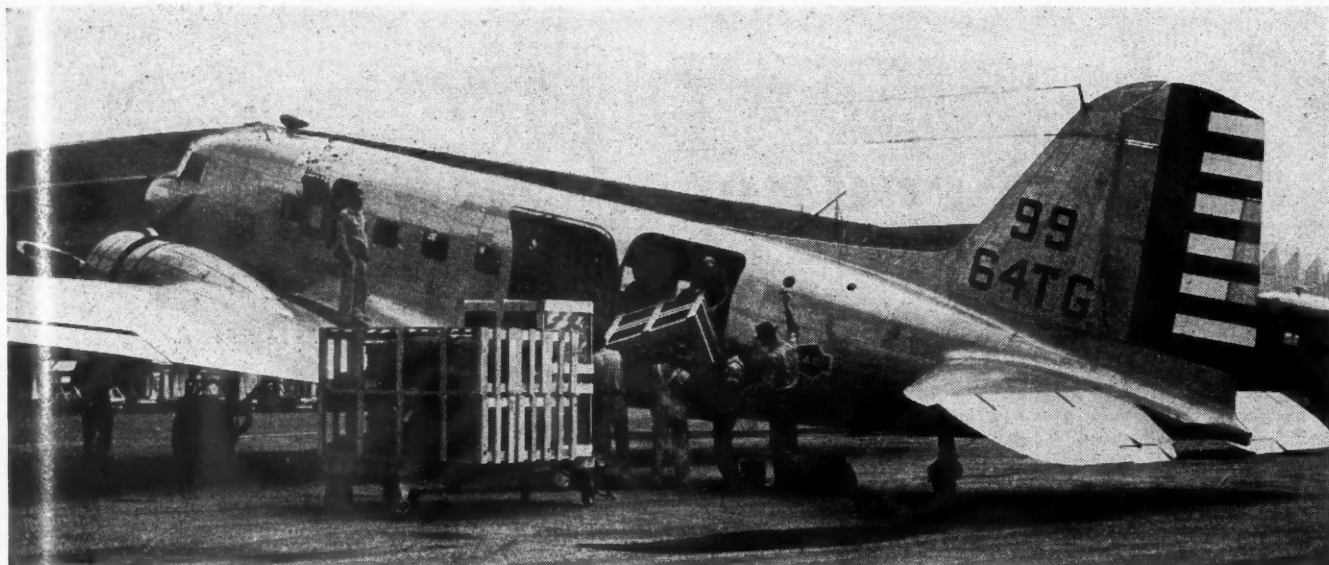
# **Air Cargo**

air cargo depends upon the advantages that transport possesses in speed and convenience, said Carlos Wood, chief of preliminary design section, Santa Monica plant of the Douglas Aircraft Co. His paper was entitled, "Design Considerations of the Cargo Airplane." The author pointed out that evidence indicates a tremendous increase in potential cargo available as air cargo rates are reduced.

Regarding the design of the cargo airplane, Mr. Wood mentioned that the structural design of floors, tie-downs, etc., are basically dependent only on the cargo load that the airplane may carry and on the cargo volume available. He discussed the relative disadvantages and advantages of under-floor and above floor cargo compartments, as well as some advantages of the convertible cabin and its application in the immediate postwar period. Detailed decisions as to access, loading, tie-downs, etc., depend on the operational conditions.

Economic considerations, the author said, show that the actual operations of the cargo airplane will determine the relative importance of speed of loading and the weights involved. Short range operations demand speed of loading, but long range operations demand minimum weight penalties. It was shown by Mr. Wood that the big potential field for air cargo lies in the transportation of perishable and relatively high valued classes of goods.

Along this line, air cargo terminal workers are now practically immune to "surprise" shipments. Canary birds come through without a single casualty in one flight from coast to coast. Crates of valuable little chinchillas marked



# Problems *are many and varied*

for shipment to Middle West fur farms reach their destinations without a fatality. Indeed, the modern air cargo is made up of everything from orchids to heavy machinery.

In speaking of the use of air freighters in areas not served by other adequate means of transportation in Northern Canada, W. L. Brintnell, Aircraft Repair, Ltd., brought out many interesting facts. Among them was the shipment of a piano by air into a mining development. Pontoons belonging to aircraft marooned in some part of Canada for winter have been flown as far as 900 miles. Many flights are made over country not as yet mapped and where surface transportation is wholly out of the question. Mr. Brintnell stated that with the tremendous amount of knowledge now available in the art of building aircraft, provided the right power plant was available, the convertible type air freighter could be built very cheaply and believed the cost of operation of this type of plane must come down considerably from its present figure to enable people living in isolated districts to take advantage of the passenger and express fares. One of the greatest factors in the development of any pioneer industry is the personnel problem. Men who work in these areas receive good wages and excellent food, but in addition to this they must have home life and be accessible to civilization. This can all be accomplished by an efficient air freight with low operating costs.

In his paper, "Payload vs. Operating Speeds—Air Transport Operations," J. G. Borger, Pan-American Airways System, stressed the importance of design-

ing more speed into the airplane, since speed is the prime commodity of air transportation. The author discussed the effect of operating procedures on payloads which indicate the desirability of using constant power for short range and some medium range operation, and optimum air-speeds for all operation over approximately 1500 miles. As a matter of fact, if one is comparing one airplane with another it may be somewhat better to compare in terms of hours rather than miles and say that the dividing line is in the region of a seven-hour flight. That is, those less than seven hours should be at constant power, those greater, at optimum airspeeds. The use of hours provides a better comparison between different airplanes since the rate of change in gross weight is more a function of time than a speed. Mr. Borger went into detail on the effects of altitude, climb, wind, reserve, turbulence, landing, gross weight maneuvering time and others in so far as plane design is concerned.

There are a number of variables which affect operating speeds, he said. One example is a limitation on operating rpm, due to propeller or engine vibration characteristics in a certain rpm range, airplane or engine mount vibration characteristics, minimum pro-

peller governing rpm, minimum rpm at which the electric generators will supply power, etc. In such cases it is usually not desirable to let the speed decrease further, but rather to maintain constant airspeed and reduce power by reducing the bmep, and maintaining constant rpm.

In speaking of the "Basic Fundamentals of Packaging Air Cargo Shipments" J. H. MacLeod, Hinde & Dauch Paper Co., said that much can be done at the source in proper packaging. Vast savings in weight have been made possible by packaging engineers who have devised new forms of special corrugated paper boxes for a variety of uses. No one material, however, is applicable for all shipments. In surface transportation the weight of the container was never given much consideration. Usually it was only a question of a strong crate or box to protect the contents. Conversely, in air cargo weight is the all-important factor.

For example, one item packed in a wooden box weighed some 500 lb. The same article repacked in a paper carton before being loaded into a cargo plane weighed 200 lb. Mr. MacLeod also stated that many large items can be repacked into a number of smaller containers for air shipment. To date the corrugated box still is considered best, although a new type of heavy wrapping paper has been developed making possible the elimination in many instance of boxes, thus reducing weight still further.

Three important facilities—airports, their pick-up and delivery services, and their handling equipment involved in coordinating air and surface cargo

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# Products for Aircraft

## Hydraulic Fuse for Aircraft

Simmonds Aerocessories, Inc., Long Island City, N. Y., is releasing information on the hydraulic fuse (quantity measuring type) now being produced for installation on U. S. military aircraft.

In the event of a ruptured, or bullet-pierced hydraulic line and escaping fluid, the fuse will act as a safety shut off, after a measured quantity has passed through the fuse. Thus the balance of the fluid supply of the hy-



*Simmonds Hydraulic Fuse*

draulic system is saved and the rest of the system remains intact and usable.

The Simmonds Fuse is said to operate successfully regardless of variations in either oil viscosity or rate of flow. Due to the action of its internal dashpot, rates of flow even as high as 20 gallons per minute do not affect its basic functioning. The fuse also is not affected by back pressure, surges, nor even by large amounts of air left in the system by incomplete bleeding.

Fuse capacities range from 10 to 40 cu. inches. A 40 cu. inch fuse will protect an actuating cylinder whose displacement is 40 cu. inches or less and so on according to size.

## Rivnuts Available for General Use

Production of "rivnuts," a one-piece combination rivet and nut plate developed by the B. F. Goodrich company originally to fasten its rubber de-icers to airplane wings, has now expanded to the point where the fasteners can be offered for general industrial use.

Although rivnuts were invented in 1935 to provide a better de-icer attachment than the combination of rubber cement and lacing cord used in early applications, the aircraft industry demand for fastening de-icers and wing and fuselage assemblies has been so

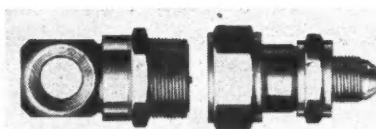
great that no surplus has been available for manufacturers in other fields until recent production gains. Even now rivnut use is limited to industrial applications backed by sufficient priority ratings.

The device is a threaded, tubular rivet which, by means of a special tool, can be headed while working entirely from the "other" side, thus making it possible for parts to be fastened onto otherwise unreachable inside surfaces or in tight places where a worker could not operate. It can be used as a straight rivet, permanently headed on both sides, and the interior threading permits insertion of a screw so that the parts can later be separated.

The rivnuts are made of an exceptionally strong aluminum alloy which, it is claimed, will not crack or fracture and which has high corrosion-resistance. They require no heat treatment before use.

## Self-Sealing Coupling

A disconnecting self-sealing coupling, said to withstand 2500 psi after ordinary finger-tightening, is a recent development of American Screw Products, Los Angeles, Cal.



*Self-sealing coupling made by American Screw Products*

Tests under severe handling conditions show that the heavy construction of the aluminum alloy body prevents distortion, and that jamming of the spring-loaded shut-off valve is prevented. One sample coupling was purposely crush-tightened with a long-handled wrench, yet is reported to show no leakage upon disconnection or re-assembly.

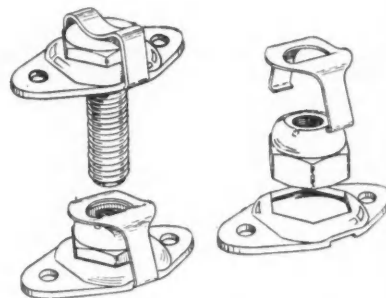
Springs are of heat-treated steel. Lightweight cast phenolic poppets are positive-sealing in action. The synthetic gasket provides leakproof connection when coupled for service. Available with AAF or AN threads.

## Nut and Bolt Retainer

"Click," a nut and bolt retainer produced by Kaynar Manufacturing Co., Los Angeles, Cal., is adaptable to any aircraft, marine or ordnance nut or bolt, and is interchangeable with present types of anchor fittings, except where slightly greater width would cause interference.

Approved by the U. S. Army Air Corps and C. A. A., Click consists of a retainer plate and a retaining spring, both of cadmium plated spring steel.

Incorporating the features of stand-



*Nut and bolt retainer made by Kaynar Manufacturing Company*

ard anchor nuts, Click also provides a nut anchor that can be spot welded to the assembly without affecting its serviceability as well as a bolt anchor using standard AN bolts, both with axial flexibility. It also allows the conversion of nut plates to blind studs without tooling change while the part is in production.

With Click, stud retainers can be riveted or spot welded early in production and the bolt inserted and locked in place with the retainer spring any time later.

## Sound Deadening Material

A new sound-deadening material has been developed by the United States Rubber Company, New York, N. Y. The new product is known as Vibeson. It is made of asbestos and other non-strategic materials. It serves both to deaden sound and dampen vibration. The only other known material comparable for this purpose in planes is mica, the major supply of which was cut off from India by the war.

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# Airbriefs

By Henry Lowe Brownback

## Efficiency

With the end of the war we can expect that air travel will be greatly expanded both in freight and passenger services, but we must also remember that, from the present outlook, our postwar planes will have about the same type of plane structure and engines as our present large bombers. It takes "oceans of gasoline" today to conduct a 800-mile, 1000-plane bombing raid, but if the airplane is going to have the vogue expected of it there will be at least the same mileage run every day by the civil aircraft of the world. If the petroleum supply is strained at the present, then some other types of powerplants and planes will have to be envisaged for the future. Some persons will immediately shout "Diesel" engines without thinking that the present-day aircraft engine uses almost as little poundage of fuel per hour as a Diesel of the same power. The fuel of an airplane not only propels it, but builds the road upon which it runs and the building of that road is in my mind the logical point of attack. Present-day wings may seem efficient, but so did the airfoils and structures of the last war seem efficient at that time. Increased speed and wing loadings now bring a decrease in power loading and a nice balance must be maintained. However, there is no doubt that airplane design and airfoil design will be greatly improved not only to provide more efficient operation but to give a greater spread between top speed and stalling speed so that a very high speed airplane can have a lower take-off and landing speed than is possible today.

Years ago when I was studying some of Langley's very interesting work and writings I ran across a table prepared by another scientist who had calculated the power, the wing loading and power loading of most of nature's fliers. Here it is in par; The Humming Bird has a wing loading of 0.577 lb. per sq. ft. and a power loading of 15 lb. per hp, the Condor 1.7 lb. per sq. ft. and 395 lb. per hp, the wild goose 3.4 lb. per sq. ft. and 346 lb. per hp, and the pigeon 1.429 lb. per sq. ft. and 83 lb. per hp. If these loadings are anywhere near the mark they are worth a considerable amount of study. Naturally the wing loadings are very low and, therefore, high power loadings are to

be expected, but nature seems to still have something on man in the economical application of power for flight.

## Gliders Again

The poor glider seems to have been the uncertain child of the Air Corps. One day he was the "fair-haired boy" and the next he languished in the dog house. I think that the glider has done some mighty good work and that as an aircraft it was more sinned against than sinning. It was designed to glide and not to ride or rather be buffeted about in wake of a high speed airplane. Most of us know what a buffeting the tail surfaces of an aircraft gets especially in multi-motored machines. The recent move to class gliders which being towed by power craft as "towed aircraft" rather than gliders is one of the best steps which has ever been taken and the performance of wind tunnel models of such machines should be studied under "wake" and not smooth air conditions. If you have ever ridden in a canoe hooked to a high speed motor boat you will get a little idea of what the glider is getting.

## The Mars

This great ship which has had almost as much bad luck as her great waterborne sister the Normandie is at last a naval vessel and we all wish her the best of luck over a long and useful career. She may be the forerunner of a line of great flying boats and much valuable data certainly will be obtained from her. The feat alone of building a hull light enough to be carried by wings, efficient enough to get the speed necessary to take-off with the power available and strong enough to take the shock of a rough landing is monumental and after you have done that you can start to think about the airplane end of the great machine.

## These Big Planes

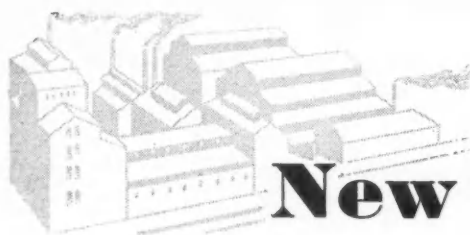
The "land sister" of the Mars has not been as successful, but it certainly served a very useful purpose as a forerunner of the new super fortresses that have recently been made public. I believe that I have pointed out before that land planes present a great

problem in landing and taking off after they reach a huge size as wheels and tires can take just so much and the landing strip under the wheels has not unlimited carrying capacity with this concentrated load. This latter can be remedied rather easily but some means of take-off launching apparatus and landing scheme other than 2 or 3 wheels on pneumatic tires will have to be developed. In the old days wheels were very useful as airplanes landed and took off out of flying fields with uncertain surfaces and a safe pilot was one who never permitted himself to get out of sight of a possible landing field. With today's landing runs and speeds and the size of modern aircraft, an emergency landing in an ordinary field is out of the question and the necessity for wheels on these large multi-motored aircraft has just about disappeared provided some other device can be developed. The modern "Landplane" of the transport size can be more safely landed on the ocean than in a rocky ploughed field.

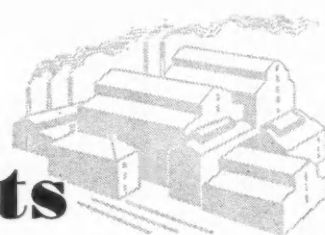
Another problem will be the power operation of all control surfaces. Present day bombers are about the limit for manual control and one of our best known requires pilots who are selected largely on a basis of brawn and, in fact, on all of them the operation of the rudders through pedals at full speeds is just about impossible. Before the war I saw several French layouts for the "servo" operation of controls most of them using oil under very high pressure, from 3000 to 4000 psi. A small pump on the engine took oil from a reservoir and pumped it into a tank which consisted of a hermetically sealed metal shell with a small synthetic rubber bladder inside. As the oil was pumped into the bladder it compressed the air surrounding it so that the actual bladder never was subjected to much strain. The oil was used to operate about everything on the plane including the starter on some of the high-powered engines. Hydraulic fluid under low or medium pressures can be shut off by small blockages in fine tubes, but with this amount of pressure back of it such blockages are almost impossible.

## Aluminum

I think that most of the readers of AIRBRIEFS have at sometime or other wished to make something of aluminum and then changed to another metal which could be more easily welded or soldered, particularly when it was desired to do this by putting assemblies together with sheets of the bonding metal between the surfaces to be bonded and then sending the assembly through a controlled atmosphere furnace or by dipping assemblies in molten bonding metal. Up until a short while ago this method of doing things could not be applied to aluminum, but a recently-invented alloy can be used in furnace brazing, thus opening up a whole new field to the light metals.



## New Products



### Koroseal Tape RX and Koralac RX

Two new products for covering plating racks, used in many varied industries, made from Koroseal, its plasticized polyvinyl chloride thermoplastic material, are announced by The B. F. Goodrich Company, Akron, Ohio.

One is known as Koroseal Tape RX, while the second is Koralac RX, a solution of Koroseal. In some applications the two are used together, with the tape being applied after the rack has been coated with the solution, while in other cases they may be used separately.

Koroseal Tape RX possesses good resistance to wear and abrasion, has excellent insulating properties and can be used for practically all kinds of plating service, since it has remarkable resistance to all plating solutions, including chromic, alkali and acid dips, the company's announcement says.

Length of service from a rack covered with Koroseal Tape RX depends on the physical use to which the rack is subjected and not upon chemical deterioration of the tape, which will withstand much more severe service than any liquid coating now in use, the company claims. Any shape or style of plating rack which can be covered with regular friction tape can use the new product.

Made in glossy black, Koroseal Tape RX is supplied in one-pound rolls, containing approximately 170 lineal feet,  $\frac{3}{4}$  in. wide by .014 in. thick, with the tolerance on width plus or minus  $\frac{1}{16}$  in. and plus or minus .002 in. on thickness.

### Cleaning Process for Aluminum Pistons

The Curran Corporation, Malden, Mass., has placed on the market a new solvent and process for cleaning aviation service pistons.

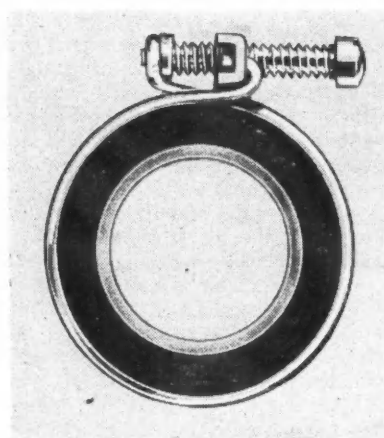
This process is said to be a combination of the chemical solvents supplemented by a mechanical hydraulic blast to which is added a cereal or plastic abrasive which is said to be highly effective in removing the last trace of hard refractory-like carbon from the piston lands and ring grooves without harmful effect to the mirror finish surfaces.

It is stated that 1,000 hour service

pistons may be effectively and thoroughly cleaned with the new Hydro-Blast process in less than  $\frac{1}{3}$  the time normally applicable to flow-line production methods of engine overhaul and assembly.

### Clamp with Uniform Clamping Pressure

A powerful hose clamp with 360 deg. uniform clamping pressure is being offered by the Central Equipment Co.,



Central "360" hose clamp

Chicago, Ill. It is called the Central 360, and is said to remain a perfect circle, with equal clamping pressure at all points, regardless of the amount of pressure applied. The principle of the tightening element is "push" plus "pull," with unlimited take up. The maker states that clamping power is unaffected by rough castings or variations in hose diameter and resistance. The new clamp may be attached or removed without disconnecting the hose line.

### Fire Extinguisher Operates Single Handed

Randolph Laboratories, Inc., Chicago, Ill., has produced a carbon dioxide fire extinguisher that requires only one hand in operation—from the moment the unit is grasped until the fire is completely out. "Model FF-4" features a self-aimed, fixed discharge horn, and a thumb-operated trigger valve that re-

leases a penetrating blanket of carbon dioxide.

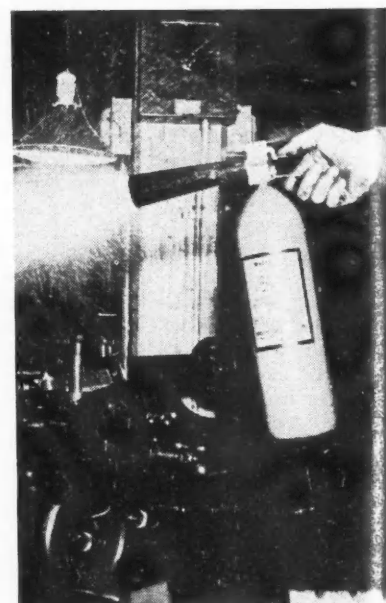
The operator, as though aiming a revolver, grasps the extinguisher's arched-steel handle, while the thumb presses the trigger directly above. The fire-resistant horn, permanently regulated to fixed firing position, eliminates the necessity of making aiming adjustments.

### New Synthetic Rubber

A new synthetic rubber, the sixth major type to be discovered through chemical research, has been developed by the United States Rubber Company, New York, N. Y. Known as Uskol, this new synthetic is expected to take its place alongside the present five commercial types of synthetic rubber—buna S, buna N, neoprene, butyl and thiokol.

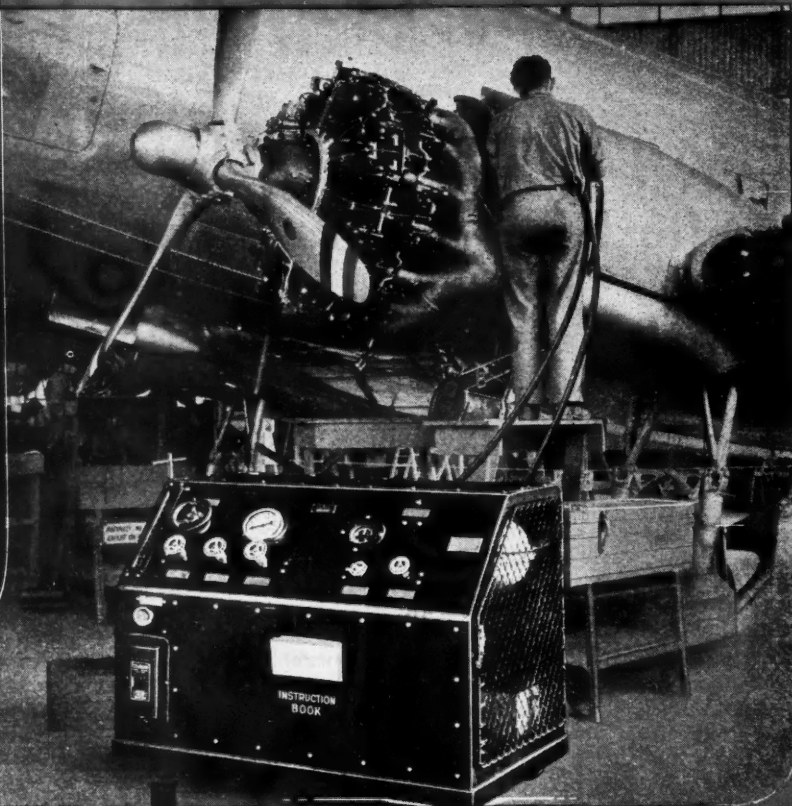
Offering a new high degree of resistance to solvents, this new synthetic is suitable for use in the manufacture of commodities which come into contact with fuels, oils, gasoline, dry cleaning fluids and other penetrating chemicals which are the enemies not only of natural rubber but of the other five synthetic types. It may also be used

(Turn to page 58, please)



Randolph Model FF-4 fire extinguisher

# Sphygmomanometer



*it tests the "BLOOD PRESSURE" of airplanes*

Your doctor uses a sphygmomanometer when he checks your blood pressure . . .

Similarly, the test stand in the photo above is what the ground crew uses to check a plane's hydraulic system—the system that furnishes power for swift, foolproof control of ailerons, elevators, rudders, bomb-bay doors, landing gear, propeller-feathering mechanism, wing flaps and brakes.

A pump at the plane's motor is the "heart" of this hydraulic system. To make a test, connections from pump to system are switched to the Hydrollic test stand, the circuit is completed by starting the tester, and the plane's hydraulic system is quickly checked at test pressures.

In addition to hydraulic circuit testers, Denison builds many other test stands for checking the *flight* performance of aircraft *on the ground*! There's a Hydrollic unit that checks aircraft spark plugs. Another

tests magnetos. A third tests the feathering action of propellers—and there are still others.

★ ★ ★

You'll also find Hydrollic equipment used in the production and assembly of airplane parts . . . and used in the airplanes themselves. Hydrollic valves, cylinders, motors and pumps are built into many types and makes of production machinery in all industry.

Denison Hydrollic engineers have proved their unusual ability to get better answers to all sorts of production, testing, and movement-control problems. This, added to the exceptional *accuracy* and *flexibility* of fluid (oil hydraulic) power transmission, is the reason for the wide use of Hydrollic equipment. Denison may already have the answer to your own problems, or perhaps know a short cut to the best solution. Your inquiry will bring the desired information. Please write. The DENISON Engineering Company, 1178 Dublin Road, Columbus 16, Ohio.



**Industry's Right Hand**

**DENISON**  
EQUIPMENT *in* APPLIED  
*Hydrollics*



## 81,366 Trucks to Be Made in 1944 for Essential Transport

*A Total of 123,492 Trucks Will Be Produced in 1944 for All Claimants Except the Military*

In announcing the most realistic truck program that has emanated from the War Production Board, R. L. Vaniman, Director of the Automotive Division, stated that ODT's request for trucks for 1944 would be met in its entirety.

There will be a total of 123,492 trucks produced in 1944 for all claimants except the military, giving the nation's essential transport 81,366 new trucks. The fact that all the vehicles will be produced under a single schedule makes both WPB and industry feel that the program will be met.

In the past the Army has insisted on receiving its full allotment of trucks, regardless of its impact on essential civilian transport. The Army has now recognized the need for civilian production as an aid to maintaining an efficient military establishment in the United States. Mr. Vaniman said that one agency will undertake the expediting and all claimants will share equally according to agreed allotments in the total number of vehicles produced under this program.

The Army is now responsible for the entire program, for any cutbacks will be shared equally, and to realize its own production it must aid in implementing the production of all trucks. For example, if the entire program should be cut 25 per cent all claimants would be cut equally.

To realize the enormity of the production necessary to meet all needs WPB says that only 13 or 14 per cent of the country's unit production would go to civilians, even if the program is met.

In addition to the 81,366 trucks that will go to ODT, Lend-Lease will receive about 30,000, the Office of Economic Warfare approximately 9500 and the remainder will be divided between

(Turn to page 48, please)

### More Replacement Parts to Be Made

Limitations on the quantity of functional replacement parts that can be produced and the quantity in manufacturers' inventories are lifted by amend-

ments to Limitation Order L-158 made effective Nov. 13 by WPB. Since last April parts manufacturers have been limited to a rate of production that would not raise their inventories at the end of each 1943 quarter, on a dollar cost basis, to more than the value of the inventories on April 1, 1943. Manufacturers were given 60 days to adjust their stocks to the April 1 figure.

Items added to the list of functional replacement parts that can be produced are window actuating mechanisms, front fenders which house headlights, windshield defroster components and heater hose for all vehicles, and for medium and heavy trucks the following: front fenders without limitation, hoods, marker, clearance and identification lamps, internally controlled spot lamps, fog and back-up lamps, signaling devices, reflex reflectors, windshield defrosters and truck and bus traction sanders.

In the standardization of parts, there have been added an additional oversize to piston pins, .010, in. and an additional oversize to piston rings, .005 in. Additional undersizes to engine bearings, .040 in., .060 in. and .090 in. have been authorized, as have connecting rod bearings with oversize outside diameter and special length Ford main bearings. A standardization of tungsten ignition contacts, limiting thickness to .030 in. maximum, with an .002 in. tolerance.

All parts for medium and heavy trucks must be produced as if the order bore a preference rating of AA-1, except certain markers, reflectors, lamps, defrosters and sanders. The latter, together with passenger car and light truck parts, carry a production rating of AA-2-X. Heavy and medium truck parts that can be sold without requiring a turn-in used part now include heavy duty generators, auxiliary transmissions, power takeoffs, heavy duty, trailer axles, wheels and rims which do not increase tire sizes, lamps, signaling devices, reflectors, windshield defrosters and sanders.

WPB has been given authority to order any distributor to sell parts available for civilian distribution to any other person at regularly established prices in order to relieve critical shortages.

### Planned Production in 1944 of Commercial Type Motor Vehicles Other Than Military Direct Procurement

Manufacturer	Medium 9,000-15,999 G.V.W.	Light-Heavy 16-24,000 G.V.W.	Heavy 24,001 and Up G.V.W.	Total Heavy	O.D.T.- Highway	Grand Total	Authorized Prior to 11/9/43
Autocar	X	X	3,475	3,475	X	3,475	3,962
Brockway	X	X	250	250	X	250	550
Chevrolet	37,714	X	X	X	X	37,714	8,449
Corbitt	X	X	50	50	X	50	125
Dart	X	X	X	X	150	150	166
Diamond T	X	X	X	X	X	X	817
Doane	X	1	X	1	X	1	X
Dodge	10,860	X	X	X	X	10,860	2,763
Duplex	X	X	10	10	X	10	10
Euclid	X	X	X	X	522	522	522
Federal	X	X	570	570	X	570	570
Ford	32,001	X	X	X	X	32,001	7,169
F.W.D.	X	X	214	214	117	331	348
G.M.C.	X	200	840	1,040	X	1,040	3,436
I.H.C.	11,144	10,960	2,430	13,390	X	24,534	6,938
Kenworth	X	X	100	100	15	115	115
Koehring	X	X	X	X	59	59	59
Linn	X	X	X	X	20	20	20
Mack	338	5,163	295	5,468	307	6,103	2,364
Oshkosh	X	X	X	X	117	117	217
Peterbilt	X	X	100	100	217	317	392
Reo	X	210	150	360	X	360	443
Sterling	X	X	150	150	105	255	395
Walter	X	114	142	256	X	256	141
White	X	4,382	X	4,382	X	4,382	1,801
<b>Total</b>	<b>92,057</b>	<b>21,030</b>	<b>8,776</b>	<b>29,806</b>	<b>1,629</b>	<b>123,492</b>	<b>41,774</b>
<b>Claimants:</b>							
O. D. T.	59,550	14,348	8,468	22,816	X	81,366	
Lend-Lease	25,117	5,116	56	5,172	X	30,289	
Economic Warfare	8,077	1,371	227	1,598	18	9,683	
Maritime	313	165	X	165	X	478	
Canada	X	30	25	55	152	207	
W. P. B.	X	X	X	X	1,459	1,459	
<b>Total</b>	<b>92,057</b>	<b>21,030</b>	<b>8,776</b>	<b>29,806</b>	<b>1,629</b>	<b>123,492</b>	

# What will users want in POSTWAR Machine Tools?

**1. VERSATILITY** will be a primary requirement of many machine tools sold in the postwar period . . . but versatility achieved without sacrificing high production rates and low production costs. Following every war, old products become obsolete and new products are developed with startling speed. Manufacturers must have machines which can be quickly and easily adapted to new purposes.

Exceptional versatility is characteristic of many machines equipped with Vickers Hydromotive Controls. The hydraulic method of control and power application is inherently the most flexible. There are more than 5,000 Standardized Vickers Units that can be combined to exactly supply every hydraulic power and control function:

- |                       |                                      |
|-----------------------|--------------------------------------|
| (1) any feed rate     | (4) any sequence of motions          |
| (2) any traverse rate | (5) any acceleration or deceleration |
| (3) any rpm           | (6) any thrust                       |

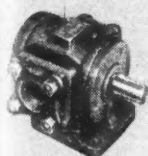
Vickers Application Engineers will be glad to discuss how the versatility and the many other advantages of Vickers Hydromotive Controls can be applied to your machines.

**VICKERS** Incorporated • 1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN

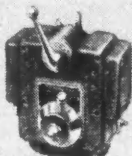
Application Engineering Offices:

CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCKFORD • TULSA • WORCESTER

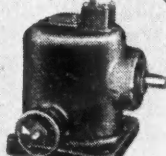
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than 5,000 Standardized Vickers  
Units for Every Hydraulic Power  
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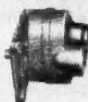


CONTROL  
ASSEMBLIES

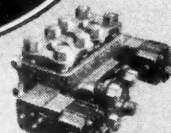


VARIABLE DELIVERY  
PUMPS

FLUID  
MOTORS



VOLUME CONTROLS



DIRECTIONAL  
CONTROLS



PRESSURE  
CONTROLS

## Trucks to Be Made for Essential Transport

(Continued from page 46)

the Maritime Commission, the Canadian government and various WPB industry divisions.

ODT's share will include 58,550 medium trucks ranging from 9000 to 16,000 lb. gross vehicle weight; 14,348 light heavy trucks ranging from 16,000 to 24,000 lb. gross vehicle weight; and 8468 heavy trucks. Mr. Vaniman said that this new program absorbs the allocations announced in September for the first six months of 1944. He also said, by the end of the year, 330 heavy duty trucks will have been produced, instead of the previously announced figure of 7500. Broken down into quarterly quotas civilian trucks will be produced as follows:

1944	Medium	Light-Heavy	Heavy
First quarter	6,250	500	1500
Second quarter	12,062	1000	1500
Third quarter	20,118	6424	2734
Fourth quarter	20,120	6424	2734

WPB said the program represents a four-fold increase and has made the program a "must" with priority ratings equal to those for aircraft and high-octane gasoline.

"We fully expect to realize the entire program," Mr. Vaniman said.

Industry views the situation with some optimism and expressed doubt only in connection with the protection of heavy trucks. The allocations were presented to the manufacturers on Nov. 12. However, should production of "heavies" fall behind a plan is underway which would supplement any shortage of "heavies" with additional trucks in other weight categories, where components are not a major problem.

Mr. Vaniman expressed the view that the component problem would be licked, as was done in the case of aircraft. He said that existing facilities for components would be fully utilized, and if they proved inadequate, as is likely, then an expansion program would be carried out. He did not expect any expansion would be necessary until the last half of 1944, when the program would be swinging into high gear. It is expected the first trucks will roll off the lines in early January.

To insure proportionate deliveries to all claimant agencies, both for civilian and military use, all requirements for trucks have been pooled and, in terms of critical components, all rear axles, transmissions and engines will be scheduled from raw materials to finish truck. Production experts from the Army and the ranks of WPB consultants have been assigned to the job of maintaining a steady flow of components.

Mr. Vaniman pointed out that "In making out this program due consideration was given to the requests of transportation for replacement parts, and percentages based on past history and boosted upward have been set aside for this purpose."

The requirements for construction and farm machinery, general industrial equipment and other uses which require the same type of axles, transmissions and engines as trucks, were also considered in making the truck allocations.

Although the program does not approach pre-war production of approxi-

mately 700,000 vehicles annually, it is expected that as the war draws to a successful conclusion in Europe more and more capacity will be devoted to civilian trucks.

Manufacturers are having contracts for certain types of vehicles canceled at present and this cancellation is expected to continue at an increased tempo. This new WPB program gives civilian production a place alongside military needs and cuts civilian needs in on supplies.

## Union Accused of Trying to Take Over Management of Willow Run

*The Plant Is Producing More 4-Engined Bombers and Knocked Down Sets than Any Other in Nation*

Officials of the Ford Motor Co. accused Local 50 of the UAW-CIO with trying to take over the management of the huge Willow Run bomber plant as the outgrowth of a two-day strike of 1,200 employees in the press dept. The company charged that union officers have been "needling" the War Dept. and the government for months with criticism of the Willow Run management and operation.

"They suggested more than once that the management of the plant be given to a committee including representatives of the union and Army officials," said an official Ford statement. "The pressure being applied now, and very possibly the strike at the plant has been given increased impetus by those who wish to grab Willow Run before the

actual success of the plant, from an actual production and efficiency standpoint, makes it impossible. . . . The plant is producing today more 4-engined bombers and knocked down sets than any other plant in the nation. Those people in the labor union business who are looking for a plant to grab have had their eyes on Willow Run from the start. Now that the plant is beginning to hit peak production figures, they are anxious to move in before the operations become so successful that such a move would be impossible."

The company's charges may have some substantiation in the resolution of the UAW-CIO renewing its no-strike pledge adopted at the annual convention in Buffalo in October. The final part

(Turn to page 80, please)

## General Motors Total Net Sales at All Time High

*Chrysler Corp. Net Sales for First 9 Months of 1943 Were 54% Greater than in Same Period of 1942*

General Motors Corp., currently producing war materials at a rate in excess of \$10,000,000 daily, has delivered \$2,525,280,753 worth of armaments in the first nine months of 1943. This is greater than total net sales in any previous year and 2.1 times greater than war shipments in the first nine months of 1942. Chrysler Corp. net sales of both civilian and military products for the first nine months of 1943 totaled \$651,008,540, a 54 per cent advance over the first nine months of 1942 but \$14,517,014 less than the first nine months of 1941. No breakdown is made between military and civilian output in the Chrysler report. War products accounted for 94 per cent of GM net sales in the first nine months of 1943. On a similar basis, Chrysler war output would be approximately \$619,450,000 for the nine-month period.

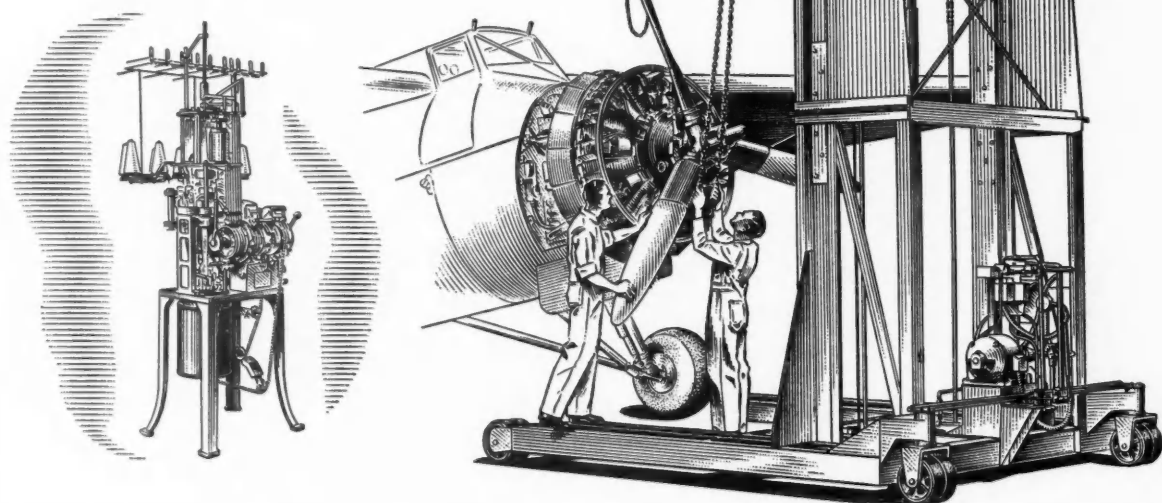
A. P. Sloan, Jr., GM chairman, pointed out that voluntary price reductions by GM in the third quarter amounted to \$57,000,000, thus indicating that war shipments increased more than the dollar volume indicates. Third quarter volume of war deliveries totaled \$927,479,569, a gain of 11.4 per cent over the second quarter shipments of \$832,275,349. Chrysler Corp. third quarter net sales, including civilian products, totaled \$215,603,223 compared to second quarter sales of \$231,778,717 and first quarter sales of \$203,626,600.

Commenting on the GM deliveries, Sloan said, "The changing demands of war still require a constant revision of production schedules. The production of certain types of war products has been reduced in recent months. As these adjustments take place total pro-

(Turn to page 56, please)



# The Engine Hoist "Lifted" an idea of the Knitting Machine's



PERHAPS IT SEEMS ODD—an aircraft engine hoist picking up an idea it could use—in a textile mill. Builders of knitting machinery are constantly striving for speed and more speed, greater efficiency of operation. Small wonder the knitting industry was among the first to adopt the Torrington Needle Bearing—its low coefficient of friction insured quicker response, and efficient lubrication permitted operation over long periods without any attention.

But the aircraft engine hoist is in no great hurry. How much overloading it could stand, and how dependable it might be—particularly at flight bases in steaming jungle, arid desert and frozen wasteland—concerned hoist designers principally. Yet they specified the Needle Bearing—for high load capacity and reliable performance. But in this unique anti-friction bearing's combination of features were several others that came in handy, helped equip our aircraft industry and air forces with engine hoists often surpassing specifications, and in less time, too.

For the Needle Bearing's low coefficient of friction speeded aircraft engine installation and overhauling... its simple, effective system of lubrication

reduced maintenance time and expense... its long service life helped "keep 'em flying," while ready availability, for such essential applications as air-

## NEEDLE BEARINGS— ALL TYPES—ALL SIZES

### NEEDLE BEARINGS TYPE DC

are complete, self-contained units consisting of a full complement of rollers and a drawn, hardened outer race. They offer the advantages of small size, low cost, high capacity—and easy installation.



**NEEDLE BEARINGS TYPE NCS** consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Needle Bearings Type NCS are adaptable to heavier loads than Needle Bearings Type DC.

### NEEDLE ROLLERS TYPE LN

are produced in a range of types and sizes for assembly on the job into low-cost, high-capacity, anti-friction bearing units. Our engineering department will be glad to advise on the correct size and type for any application.



craft engine hoists, was and is an important factor in today's staggering plane production totals and our sustained air attacks on enemy bases.

**DOES THIS SUGGEST ANYTHING TO YOU** in considering your product's design for postwar? There are any number of opportunities for increasing efficiency and reducing costs through the Needle Bearing's combination of features. And you'll have a real sales story! For Tomorrow's customers will be looking for the very advantages the Needle Bearing offers in the products they buy—light weight, compact design, easy operation, efficient lubrication, minimum maintenance. Send for Catalog No. 107 covering sizes, types and ratings, as well as list of typical applications of the Needle Bearing. In working out details, Torrington engineers will gladly help you.

## THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21, Ind.

Makers of Needle Bearings and Needle Bearing Rollers

New York	Boston	Philadelphia
Detroit	Cleveland	Seattle
San Francisco	Chicago	Los Angeles
Toronto		London, England



# • TORRINGTON • NEEDLE BEARINGS



"To fail to preserve our American way of life will mean we shall have lost the war, regardless of how complete may be our victories over our enemies abroad."

Rep. Joseph W. Martin, Jr.

## P-38 Output to Be Greatly Accelerated

Coincidental with the appearance of the super-long-range model over Germany, the War Department permitted Lockheed to announce a vast expansion program for the new quota which runs into hundreds of planes per month—five times the Army Air Forces requirement of one year ago.

Acceleration of production is being achieved by concentrating most of Lockheed's facilities on P-38 final assembly, and by sub-contracting the construction of component parts on a large scale.

Retaining the fabrication of the intricate fuselage, forward booms and tail surfaces, Lockheed will subcontract other components to dozens of precision manufacturers across the United States. Chief among them is Consolidated-Vultee Aircraft Corporation, which has patriotically set aside its own plans to devote its plant at Nashville, Tenn., to the Lightning production acceleration program. Another Convair plant at Downey, Calif., will also be assigned a share in the big push.

The Nashville division of Consolidated-Vultee is already tooling up under a contract to fabricate and assemble P-38 leading and trailing wing edges, aft booms and power plant installations. The Downey plant will build wing center sections. Eventually Consolidated will assemble complete Lightnings at Nashville, but during the expansion

stages of the program for a year or more the Nashville sub-assemblies will be shipped to Lockheed in Burbank.

Other ranking national manufacturers will build smaller components for assembly at Lockheed. The list now includes Hudson Motor Car Company of Detroit, the nationwide Rheem Manufacturing Company, and Weber Showcase and Fixture Company, Avion Incorporated, and Timm Aircraft Corporation, all of Los Angeles.

Lockheed will continue to produce its current output of P-38 fighters while furnishing master tooling, complete data and a backlog of components to subcontractors, who are still being selected.

As these subcontractors assume the load on various components, Lockheed will "taper off" and devote these released facilities and manpower to accelerating production of its own components, and to final assembly of more airplanes. Two of Lockheed's California plants will be devoted to packing, shipping and tooling as the dozens of subcontractors get into their component programs.

"Only half the man-hours are required to build a P-38 that were needed to build the 300th, and with new manpower drawn from American industry to back up our own greater efforts, we can hope the war will be brought to an earlier and more decisive end."

Selected to direct the P-38 subcontracting program for Lockheed is Mac Short, Vega vice-president in charge of engineering, whose organization flew

the first B-17 bomber out of the Boeing-Vega-Douglas "pool" months ahead of schedule last year. His P-38 Program Office is conferring with engineering and production staffs from Consolidated-Vultee, now in Burbank headed by Charles Marvin, and other Lockheed technicians are at work in Nashville.

The new quota has effected a number of changes in Lockheed's manufacturing organization, drawing liberally upon the subsidiary Vega Aircraft Corporation which will be merged into Lockheed within a few weeks. Courtlandt S. Gross, Vega's president, has become Vice-President and General Manager of Lockheed; Vega's Works Manager, L. M. Bach, has assumed that capacity at Lockheed, and Lockheed's entire subcontracting department has been expanded to meet its new volume.

## Second War Congress Of American Industry

The world premiere of the Army's latest documentary film, "The War Department Reports," will serve as the curtain-raiser for the Second War Congress of American Industry at the Waldorf-Astoria Hotel, December 8, 9 and 10.

Described in authoritative quarters as "the most gripping" documentary film of the war yet produced, the picture dramatizes the performance of weapons designed and produced by American industry. Close-up shots of battle scenes are called superior to any ever recorded by the camera before.

The Second War Congress, which marks the 49th annual convention of the National Association of Manufacturers, has been dedicated to "Production for Victory and Postwar Jobs," and top leaders of government and industry will be on hand to bring manufacturers the most authoritative views on war production and postwar problems.

Latest speakers to accept invitations to appear on the War Congress program are C. E. Wilson, Executive Vice-Chairman of the War Production Board; Senator Joseph C. O'Mahoney of Wyoming; William P. Witherow, President of Blaw-Knox Company and Chairman of the NAM Board; President Harry M. Wriston of Brown University; H. W. Prentiss, Jr., President of the Armstrong Cork Company and former NAM President.

## CALENDAR

### Conventions and Meetings

Natl. Aviation Training Assoc., St. Louis—Convention	Dec. 2-4
SAE Annual Mtg. & Eng. Display, Detroit	Jan. 10-14
Institute of the Aeronautical Sciences—Annual Meeting—New York City	Jan. 25-27



## The bird that is its own mother!

THE FABLED PHOENIX lives for 500 years. At the end of that time, it builds itself a nest in the branches of an oak or the top of a palm tree. After the funeral pyre is complete with cinnamon, spikenard and myrrh, the phoenix sets the nest on fire and burns itself alive.

From its body, or its ashes, a young phoenix issues forth, destined to live another 500 years. When it is strong enough, it carries the nest—its own cradle and its parent's coffin—to the temple of the Sun.

We think the modern parallel to this story is even more interesting, **because it's true!** Did you know that machine tools are the mothers of machines? They are the only things made by man that can reproduce themselves. And it's fortunate for us they can, because

machine tools are a measure of the degree of civilization of a country.

Machine tools are the foundation of all modern industrial production. They are not only essential for the manufacture of every class of engine and kind of mechanism, but every manufactured product—metal goods, textiles, foodstuffs, scientific instruments, building materials—all must be built on machine tools or on a machine constructed with their help!

In the post-war era, Cone Multiple Spindle Automatic Lathes will be even more essential than they are now. Their unique advantages of departmentalized control will be available to industry to help bring us all better living than we have ever known before.

**CONE Automatic Machine Company, Inc., Windsor, Vermont**



ARMY



NAVY

## Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the Nov. 15 issue of *Automotive and Aviation Industries* went to press.

ASSOCIATED SPRING CORPORATION, Bristol, Conn.  
BLACKHAWK MANUFACTURING COMPANY, West Allis, Wis.  
CHANDLER-HILL CORPORATION, Plant No. 1, Detroit, Mich.  
THE CLEVELAND PLANER, Cleveland, Ohio.  
DEVILIEG MACHINE COMPANY, Farmdale, Mich.  
THE B. F. GOODRICH COMPANY, Oaks Division, Oaks, Pa.  
HERCULES POWDER COMPANY (two plants).  
HEWITT RUBBER CORPORATION, Buffalo, N. Y.  
THE KEN TOOL MANUFACTURING COMPANY, Akron, Ohio.  
PERFECTION GEAR COMPANY, Harvey, Ill.  
SQUARE D COMPANY, Kollsman Inst. Div., Elmhurst, N. Y.  
TURNER BRASS WORKS, Sycamore, Ill.

A Star has been added to the Army-Navy "E" Pennants of the following firms for continued meritorious service on the production front.

AMERICAN FOUNDRY EQUIPMENT COMPANY, Mishawaka, Ind.  
THE BULLARD COMPANY, Bridgeport, Conn.  
DRIVER-HARRIS COMPANY, Harrison, N. J.  
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa.  
LINDBERG ENGINEERING COMPANY, Chicago, Ill.  
SEIBERLING RUBBER COMPANY, Akron, Ohio.  
PESCO PRODUCTS COMPANY, Cleveland, Ohio.  
THE WEATHERHEAD COMPANY, Cleveland, Ohio.  
WHITING CORPORATION, Harvey, Ill.

## Correction

In the article, "Salt Bath Treatment of Aircraft Parts," which was published in the Nov. 1 issue of *AUTOMOTIVE AND AVIATION INDUSTRIES*, it was stated in the last sentences on page 40 that the electrodes should be kept clean above the bath line. Stewart M. DePoy, the author, advises this instruction should be clarified as electrode life is prolonged by leaving the scale on the electrodes above the bath line, but it must not be allowed to build up too close to the contacts between the electrodes and the arms. Also, electrodes must be kept clean below the bath line.

## Mack Wins National Security Award

Presentation of the National Security Award to Mack Manufacturing Corp. has been announced by the United States Office of Civilian Defense from Washington.

## Obituary

Samuel Mack Havens, 66, vice-president of Wyman-Gordon Company, died Nov. 4 at St. Luke's Hospital in Chicago. He had been with the Wyman-Gordon Company since 1917.

Frank A. Ross, 60, senior vice-president of Stewart-Warner Corporation, died suddenly Nov. 17 at Chicago. In point of service, Mr. Ross was the oldest executive with the Corporation.

Henry G. O'Donnell, 36, assistant general counsel of the Ford Motor Co., died Nov. 9 at Detroit. He was an attorney with the Dept. of Justice before joining the Ford legal staff several years ago.

Harold L. Casto, 30, development engineer with Physicists Research Co., Ann Arbor, Mich., died Nov. 13 at Ann Arbor. He was credited with designing an instrument to gauge the finish of aircraft bearings and gears.

Max L. Tost, 63, Detroit representative of the American Bosch Corp., died Nov. 7 at Detroit after a short illness. He had been a member of the SAE since 1910.

C. H. Williams, 81, founder and honorary chairman of the board of directors of the Plomb Tool Company, died in Los Angeles on October 31.

## Niles-Bement-Pond

### Changes Executives

At a meeting of the Board of Directors held in the offices of the Company, Clayton R. Burt, formerly President and General Manager of Niles-Bement-Pond Company of West Hartford, was promoted to Chairman of the Board, and Charles W. Deeds was elected President and General Manager.

## Price of Steel Chief Worry of Producers and Consumers

### Accumulations of Alloy Steel Scrap a Problem of Major Importance. Carbon Steel Scrap Still Scarce

By W. C. Hirsch

The price of steel, a subject that for much longer than it was thought possible remained dormant, has, as was to be expected following the granting of sharply increased wage scales to the coal miners, become the chief worry of producers and consumers. Labor's pressure for upward adjustment of pay envelope contents, having spread from the steel industry to the automobile crafts, is becoming all the more serious as a result of threatened advances in the cost of steel-making materials. So, for instance, OPA has sanctioned, beginning Dec. 1, an additional charge of 31.25 per cent of the regular rate for Great Lakes transportation of iron ore, to assure as large a post-season movement as possible. More and more is the hardship clause of relief from increased costs being invoked, and the stability of the price structure is becoming increasingly subject to pressure as the result of these developments. According to the American Iron & Steel Institute, more than 4,000,000 tons, or about one-third of the country's 1943 alloy steel production, will consist of NE or low alloy steels. These emergency steels, the Institute points out, will save approximately 24,000 tons of nickel, having proved fully satisfactory in many parts of combat equipment, especially so in tank and gun parts. By one of those one man's food being another's poison quirks, which are frequently noted in the metal market, accumulations of alloy steel scrap, resulting from the machining of NE steels, have come to be a problem of major importance. Although the WPB Steel Industry Advisory Committee recently

recommended that the use of certain kinds of alloy steel scrap in the making of tool steel be increased by 60 per cent and an earlier WPB order called for 8 per cent use of alloy turnings in the alloy ingot output of all furnaces, the glut of this scrap is becoming more and more of a headache for war material contractors because of the unwillingness of scrap dealers to increase their accumulations further. Electric steel furnaces are also overstocked. At the same time, the prospects for an adequate supply of carbon steel scrap during the winter are none too reassuring, but this is in no wise affected by the abundance of alloy steel scrap, the alloying elements in which, such as nickel, chromium, molybdenum, etc., it is desired to conserve even though for the time being the need for them is apparently not sufficiently pressing to make very much of a dent in turning scrap accumulations. Regulations with reference to the delivery of stainless steel in 500-pound lots have been liberalized.

WPB announces that it has advised the Quota Committee for the Copper Premium Price Plan not to accept after Dec. 31, any applications for special copper premium prices under the plan effective for the past seven months. This reflects the much better supply of copper in sight for war needs. This improvement is also to be noted in reports that some shell case manufacturing plants are beginning to switch back from the use of steel to that of brass, the traditional shell material. Increased brass-making capacity as well as lessening of the tension in the supply of copper and zinc, the two brass-making materials, are making this change possible.

# HERE'S HOW *You* CAN "GET IN THE SCRAP"

## ALVEY-FERGUSON SCRAP SALVAGING CONVEYORS HELP YOU TO MORE EFFICIENT SCRAP CONVERSION



**YOU KNOW** that scrap reserves are declining—and at an alarming rate. Scrap that is needed for vital war products. You've been asked by Uncle Sam to back up the Nation's Scrap Conservation Campaign. But how?

Here's the first really practical, efficient and economical method—the use of an A-F *Scientifically-Planned* Scrap Salvaging System especially adapted for *your* plant!

← This A-F Pan-Type Overlapping Beaded Apron Conveyor takes the scrap (via slides) directly from the stamping presses and conveys it out through the wall to a long reversing conveyor of similar construction, which, in turn, conveys the scrap to cars at one end—or to an inclined apron conveyor discharging into trucks at the other end of the line.

← This photograph shows how the scrap is discharged directly into the cars for immediate shipment to scrap salvaging plants. No trucks are used. No manpower is wasted.

The bottom photograph shows how the A-F Portable Conveyor units carry the scrap discharged from the main conveyor directly to a trailer truck for movement to a steel mill. After one trailer truck has been loaded, scrap can be dumped into either of two other lined-up empty trucks.

... Other types of A-F Scrap Handling Conveyor Systems segregate important scrap—ferrous from non-ferrous, etc.—and dump each type of alloy into its own bin or carrier.

Whatever *your* scrap salvaging, material handling, and metal products cleaning and finishing problems—write us today.



**The ALVEY-FERGUSON CO.**  
26 Disney St., Cincinnati 9, Ohio  
Affiliated Corporation  
The Alvey-Ferguson Co. of California  
Slauson and Santa Fe Ave., Los Angeles, Cal.



CONVEYING EQUIPMENT



# Alvey-Ferguson

METAL PRODUCTS CLEANING & FINISHING EQUIPMENT



## PERSONALS

Braniff Airways has announced the appointment of **William J. Lawson**, formerly Texas Secretary of State, to the position of special representative for the company.

The resignation of **T. W. Macdonald** as director of Public Relations, Republic Aviation Corp., has been announced by the company.

**Harold I. Beadle** has been appointed sales manager for new products of the Naugatuck Chemical Div., United States Rubber Company.

**Henry Lowe Brownback** has resigned as director of engineering of Lester Industries, Inc.

Norton Company has made the following announcements regarding personnel appointments. **William R. Moore** has been made a vice-president in charge of national accounts handling ore and grain sales, and **Ralph M. Johnson** has been made general sales manager of grinding wheels and abrasive grain for the entire United States.

**Dr. Nathaniel Baum** has been appointed head of the newly created organic research department of the Turco Products Laboratory.

Announcement has been made by Perfect Circle Co., of the appointment of **Robert M. Thomas** as sales manager of the U. S. Company's automotive equipment div. He was, until his new appointment, vice-president and secretary of the Perfect Circle Co., Ltd. (Canada).

**Earl Gouldman** has been made business management manager of the Pontiac Motor Div. of Pontiac Motor Corp.

Aircraft Tools, Inc., has announced the appointment of **Harry J. Crawford** as sales manager.

**Charles W. Deeds** has been elected president and general manager of the Niles-Bement-Pond Co., succeeding **Clayton R. Burt** who has been elected to the new post of chairman of the board.

Announcement has been made of the appointment of **F. Eugene Spooner** as assistant to **Leon F. Banigan**, managing director of the National Council of Private Motor Truck Owners, Inc.

Pioneer Pump & Mfg. Co. has announced the appointment of **A. G. Fournier** as sales and service engineer in the states of California, Arizona and Nevada. His headquarters will be in Los Angeles.

**Bliss & Laughlin, Inc.**, has announced the appointment of **William C. Judy** as district sales manager.

**Edward T. McCarthy** has been vice-president and comptroller of the Casco Products Corp.

**Walter J. Ewbank** has been appointed chief engineer for the Briggs Clarifier Co., Washington, D. C.

**J. Handy Wright** has been made director of the department of industrial and public relations of Monsanto Chemical Co.

Appointment of **Herman R. Thies**, former assistant manager of the Goodyear Research Laboratory, as manager of the Goodyear Tire & Rubber Co.'s newly-organized plastics and chemical sales division at Akron, has been announced.

The B. F. Goodrich Co. has announced the following personnel changes: **John H. McGill** has been named assistant controller, succeeding **H. V. Gaertner**, recently made assistant treasurer. **Charles H. Kanavel** has been made manager of the track and war products div. succeeding **E. F. Tomlinson**, recently made general manager of the Industrial products sales div. **Chester F. Connor** has been made assistant general manager and **Fred Lang** merchandise manager of the industrial products sales div.

**L. A. Welch**, president and general manager of the Avery Farm Machinery Co., Peoria, Ill., has been appointed acting director of the Detroit Regional WPB. He formerly was assistant to the director of field operations of WPB in Washington.

**Buell E. Starr**, formerly superintendent of the Oerlikon Gun Plant, has been named manager of the aircraft torpedo plant of Pontiac Motor Division, General Motors Corp. **Clarence Mahar**, formerly general foreman of the Oerlikon Gun Plant, has been made production superintendent of the aircraft torpedo plant.

**Edward L. Usner**, formerly vice-president, has been elected president of Ross Gear & Tool Co., Lafayette, Ind., succeeding the late **Eugene Gruenewald**, who died Oct. 1. **S. L. Bradley**, formerly sales manager, has been elected vice-president in charge of sales. **W. K. Creson**, chief engineer, has been made vice-president in charge of engineering. **A. J. McAllister**, president of the Fairfield Mfg. Co., Lafayette, has been elected to the board of directors.

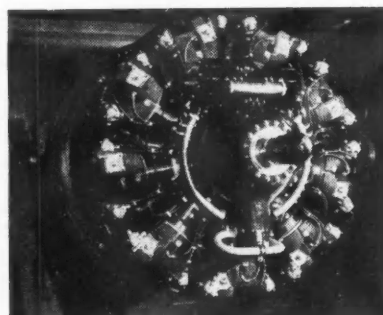
**A. G. Richtmyer**, recently on leave of absence to serve as head of the research division of the tire rationing board of OPA, has been appointed manager of the sales analysis dept., Fisk Tire Division of U. S. Rubber Co.

Members recently appointed to the Industrial Liquid-Cooled Engine Industry Advisory Committee of WPB are **Charles Balough**, Hercules Motors Corp.; **R. G. Burke**, Chrysler Corp.; **J. E. DeLong**, Waukesha Motor Co.; **R. B. Harvey**, Novo Engine Co.; **Carl Hofmeister**, Hill Diesel Engine Co.; **A. C. Howard**, Fairbanks, Morse & Co.; **R. E. Huthstener**, Cummins Engine Co.; **J. A. Mahoney**, Climax Engineering Co.; **Ralph K. Mangan**, The Buda Co.; **Bert Oakley**, Hall-Scott Motor Co.; **C. W. Pendock**, LeRoi Co.; **E. R. Redford**, Sterling Engine Co.; **C. J. Reese**, Continental Motors Corp.; **Paul Schnetzky**, Murphy Diesel Co., and **A. C. Thompson**, Caterpillar Tractor Co. **R. L. Vaniman** is the government presiding officer.

**Eugene T. Gregorie**, formerly body designer for Ford Motor Co., has opened his own offices for the design of automotive and industrial products at 3400 Eaton Tower, Detroit.

**Harry S. Tweedy**, formerly chief inspector, has been appointed manager of the field service division of the Detrex Corp.

## Newly Developed Warplane Engine



*Shown here is a Wright Cyclone 18 engine of the new 2200-hp type developed by Wright Aeronautical Corporation, of Paterson, N. J., which it has announced for the first time is now in quantity production. It has the highest horsepower figure which the War Department has ever permitted to be published on an American engine. Its 18 cylinders are built in two banks, of nine cylinders each, with a displacement of 3350 cubic inches. The new engine has a diameter of only 55 inches, the same as that of the original nine-cylinder Cyclone which was introduced in 1927 with a rating of only 525 horsepower. The engine's weight is just fractionally over one pound per horsepower*

## PUBLICATIONS

A new technical service bulletin (No. 6) has been issued by Paisley Products, Inc., covering its **water-resistant glue No. 007**. The bulletin contains a description of the product, directions for its use, applications, and a table showing waterproofing qualities, prices, etc.\*

A Training Manual, **On-the-Job Instruction of Screw Machine Personnel**, has been issued by The National Screw Machine Products Assoc. It presents easily understood instructional material in an original manner and covers all types of multiple spindle automatics. In addition to functional machine operation it includes extensive data on grinding and setting tools and comprehensive trouble charts. Copies are \$2.00 each and are available from National Screw Machine Products Assoc., 13210 Shaker Square, Cleveland 20, O.

Jessop Steel Co. has announced the publication of a new catalog on **Jessop Stainless-Clad Steel**. It contains information on analyses, applications, manufacture, fabrication, styles of heads and standard size of sheets and plates.\*

A new illustrated engineering manual (SS-44) on **Rex-Flex Stainless Steel Flexible Tubing and Bellows** has just been issued by Chicago Metal Hose Corp. Characteristics of the product are shown in detail, with tables of sizes, weights, wall thicknesses of various forms, together with pressure data, etc.\*

The **ABC of Internal Grinding** is a new booklet issued by Norton Co. It is intended, primarily, for operators of internal grinding machines and answers some very practical questions, such as how to select the proper wheel for different internal grinding jobs and how to correct common grinding faults.\*

A pamphlet has been issued by Greenfield Tap & Die Corp., giving the basic relationships between **taps and screw threads**.\*

Bulletin 320-A has been issued by Watson-Stillman Co., covering its line of **straightening and bending presses**. It includes descriptive matter, illustrations and tables of work capacities, engineering tables and other technical data.\*

An attractive 46-page booklet, **GET 1170**, has been issued by General Electric Co. It consists partly of published articles by GE engineers on the **circuits and operation of electronic controls for resistance welding**. Simplified circuit diagrams are used in explaining the fundamentals of the many types of G-E electronic controls. A pictorial presentation of all types of electronic controls made by G-E for resistance welding, accompany each article.\*

A new catalog section on its line of **Flextite rubber pouring buckets**, for safe and economical handling of acids, corrosive and liquid high explosives has just been issued by The B. F. Goodrich Co.\*

A new circular on the **Mattison No. 135 Backstand Idler** has just been issued by Mattison Machine Works. It contains details of construction, a number of installation pictures and data, and results obtained.\*

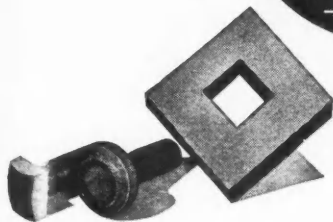
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., has issued a 140-page catalog of **industrial rubber goods**, which is known as its 50th Anniversary Catalog. It describes hundreds of mechanical rubber products and many other special items made by the company.\*

Surface Combustion has issued a new booklet, **The Heat Treating Furnace**, which briefly outlines the factors, tangible and intangible, which contribute to producing a good industrial furnace.\*

\* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.



# HOW one tool engineer eliminated tool breakage and increased production



◀ This job required a tool steel with a good combination of hardness and toughness.

## the tool:

A trimmer die for trimming cold forged blanks for machine bolts and cap screws of SAE 1020.

## the problem:

Excessive breakage resulted when the tools were left hard enough to provide maximum wear resistance. But when the tools were drawn back far enough to eliminate breakage, they required too frequent re-dressing—resulting in considerable machine shut-down time and lost production. Several types of tool steel were tried, none of which met the requirements of the job.

## the solution:

The Tool Engineer needed a tool steel that had a good combination of hardness and toughness. So using the Carpenter Matched Set Method of selecting tool steel, he found that *Carpenter No. 11 Special* promised to give a good combination of these qualities.



## the results:

With *Carpenter No. 11 Special*, a straight carbon (tough timbre) water-hardening tool steel, these results were obtained.

- 1 Breakage was licked—and production was increased from 7,500 pieces to 86,000 pieces per grind.
- 2 An increase from 5 hours to 60 hours in production time between grinds.
- 3 Machine shut-down time of 1 hour and 12 minutes per day was eliminated.
- 4 Added machine capacity—1,728 pieces per machine per day.

This is another example of how the Carpenter Matched Set Method of selecting tool steel has been used successfully. If you would like to know how it can help you get tools that give increased production with fewer interruptions, ask for a copy of the 167-page Carpenter Matched Tool Steel Manual. It contains much useful information to help you select the proper tool steel for practically any type of tool. A note on your company letterhead will start your copy on its way, so drop us a line today.



**THE CARPENTER STEEL COMPANY**  
103 WEST BERN STREET, READING, PENNSYLVANIA



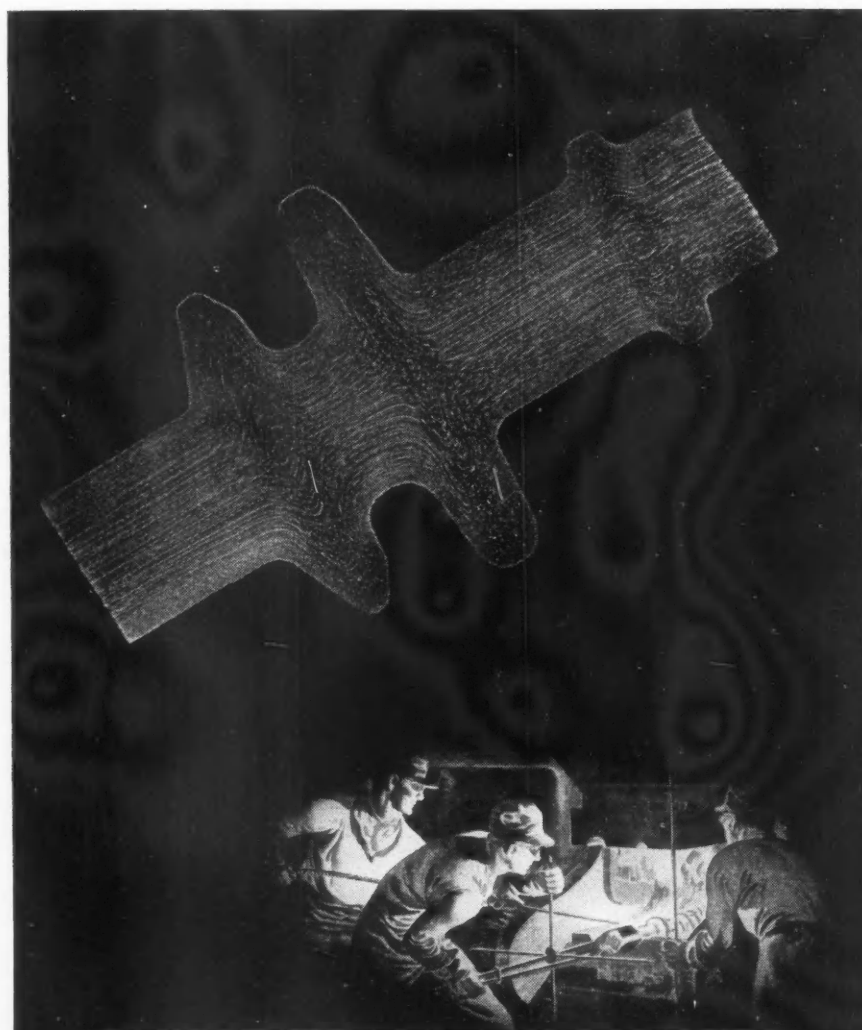
## General Motors at All-Time High

(Continued from page 48)

duction is adversely affected, because a certain amount of specialized capacity which would otherwise be contributing to production totals is removed from effective use. The capacity available for the production of specific products is seldom suitable for the production of other types of war material without a reorganization of production facilities."

GM recently opened a new war plant when the Chevrolet aluminum forge plant at Anderson, Ind., went into production. This plant, formerly the property of American Steel & Wire Co., is

the fourth Chevrolet forge unit to go into manufacture of aluminum forgings. Four buildings make up the layout, two units, each 550 ft. long, housing the processing work and heat treating furnaces. A third is the main forge plant which contains the heavy presses and forging equipment, while the fourth includes the materials testing laboratory. Equipment includes heavy hydraulic presses, large homogenizing furnaces and upsetters, one of which weighed 353,000 pounds before installation. The latter required a base 25 ft. deep.



See the grain flow, sometimes called fibre flow in this aircraft engine gearing forging—giving strength greater than any other shape of equal weight — ability to withstand unpredictable loads.

**WYMAN-GORDON**

*Forgings Laboratory Controlled*

WORCESTER, MASS.

HARVEY, ILL.

DETROIT, MICH.

It recently was revealed that another GM division, AC Spark Plug at Flint, is producing T-1 bombsights for installation in British bombers. This bombsight, used for relatively low level night bombing, was being made in England in 1941 but more capacity was needed, so Sperry Gyroscope Co., Inc., was furnished with the necessary blueprints. But Sperry was loaded to capacity with instrument work, so AC Spark Plug undertook the order Nov. 29, 1941, just before Pearl Harbor. Drawings had to be converted to American standards and the device was redesigned for progressive assembly, splitting it up into subassemblies. The T-1 bombsight contains 4,212 parts but AC engineers through redesign were able to cut the number of piece parts from 1,120 to 840. The first sample bombsight was completed May 13, 1942, and production got under way in September, 1942.

Some of the subassemblies are subcontracted to outside firms. Although many of these bombsights go into planes equipped with high pressure air and vacuum systems, which operate the bombsight, some were scheduled for planes not so equipped. To make possible installation in these latter planes, AC engineers converted a fuel pump meter into a vacuum pump for this job. A pre-war fuel meter development, which could handle 600 to 700 gallons per hour, did the trick. In the bombsight itself, rubber wheels in the servo, bearings, flex shafts and gears had to be designed to withstand temperature ranges varying from 60 degrees below zero to 160 degrees above. Tolerances of the parts are held to from .0002 to .0008 inches. The main base casting is the largest high pressure aluminum casting ever made, requiring 14 pounds of aluminum per casting. It replaces a steel plate and two steel stampings of the English design. Weight of the AC-made bombsight is 55 pounds compared to 85 pounds for the English version. New methods of machining, gauging and inspection had to be developed to take care of the job due to the type of product as well as the closer tolerances.

Wright Aeronautical Corp. has announced that it is in quantity production of the Cyclone-18 engine, a 2200-hp. type that is more powerful than any other U. S. aircraft powerplant so far revealed. Use of this engine is expected to increase the bombload and range for attacks on Axis bases. First transport installation is in the Lockheed C-69 Constellation, a 4-engine plane ordered by TWA and Pan-American Airways before the war but now converted to Army use.

Latest report on lend-lease shipments to Soviet Russia by Leo T. Crowley, foreign economic administrator, up to Nov. 1 show the U. S. has sent \$1,853,656,000 worth of war equipment to the U. S. S. R. This includes 6,500 airplanes, 3,000 tanks, 145,000 trucks, 16,000 jeeps, and 125,000 sub-machine guns. Great Britain shipped 4,690 aircraft to the Soviets in the same period.

# "HOW IS POR-OS-WAY DOING ON HIGH-SPEED STEEL CUTTERS?"

Dear Charlie:

You wanted to know how Por-os-way's doing on high-speed steel cutters. So here goes from the ~~factory~~ plant. These cutters are for finning airplane cylinder barrels. Production is up 66 2/3%. no more burning and no rejects. The boys are sure sold on Por-os-way. Can you blame 'em?

Your roving reporter,

"Vic"

READ THIS, WRITES  
POR-OS-WAY'S  
WAR PLANT REPORTER



## THE JOB:

Grinding sets of Huther high-speed steel cutters for finning airplane cylinder barrels on a universal tool and cutter grinder.

**THE WHEEL:** Por-os-way 7" x 1/2" x 1 1/4" 9A60HV2.

All facts and figures given are taken from an actual field survey made by a Por-os-way correspondent.

THE RECORD	POR-OS-WAY WHEEL	FORMER WHEEL
Production per man per hour	5 sets (20 pcs.)	3 sets (12 pcs.)
Pieces per dressing	8 to 12	3
Wheel life	8 hours	6 hours
Stock to be removed	.010"—.018"	Same
Depth of cut per pass	.003"	.001"
Rejects	None	0.5 to 1%
Operations eliminated	Cutting shoulder	
Production Increase	66 2/3%	
Remarks: Former wheel burned work. Por-os-way grinds cool, holds corner.		



Write for complete booklet "Facts About Por-os-way". The address is 466 Wheatland Street, Phoenixville, Pennsylvania.

**2 TO 5 TIMES  
MORE WAR PRODUCTION  
PER MAN PER MACHINE**

# POR-OS-WAY\*

*a new*

## RADIAC\* PRODUCT

**A. P. DE SANNO & SON, INC.**  
NEW YORK, CHICAGO, PITTSBURGH,  
CLEVELAND, DETROIT, LOS ANGELES



**PHOENIXVILLE, PENNA.**  
Western Gateway to  
VALLEY FORGE

\*T. M. Reg. U. S. Pat. Off.  
COPYRIGHT, 1943, A. P. de Sanno & Son, Inc.





## New Products

(Continued from page 44)

for specialties such as industrial molded items, tubing, gas and oil hoses, tank linings, and for application to paper and cardboard to render them resistant to grease, water and chemicals.

Household goods such as mats, dish drainers, sink strainers, aprons, gloves and the like may be made from the new rubber. It also may make possible for the first time the manufacture of raincoats that can be dry cleaned. It is not applicable to tires but it can replace

in various items other synthetics which can be used in tires.

In addition to its superior resistance to solvents, Uskol is said to possess numerous other advantages, including the following: it can be vulcanized in several ways to acquire high physical properties; it has high tear resistance, exceeding that of natural rubber; it can be used alone or as a blend with other synthetics; it is more resistant to the effects of sunlight, ozone, and oxygen

than any other synthetic rubber; it has no odor either in the raw material state or in the finished product; it can be produced with present machinery and it is easy to handle during manufacture.

This new synthetic resulted from search for a rubber which would provide greater resistance to attack of high octane aviation gasoline. Its use will be limited to war products for the duration. It will be made by the company's chemical division at Naugatuck, Conn.

### Special Rubber for Magnesium Forming

Increased service for hot magnesium forming sheets has been reported for X-84 rubber stocks manufactured by the Los Angeles Standard Rubber Company, Los Angeles, Cal. Sheets of this material are said to have been in service two hundred cycles, or five to ten times the number possible with former stocks. Reports indicate excellent service in steam up to 325 deg. F. for an extended period. The forming sheets have exceptional resistance to tearing and smudging under heat, when forming magnesium in a hot press.

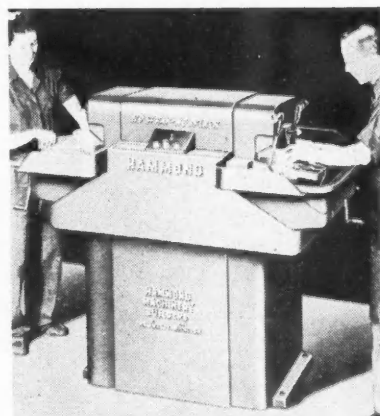
### Emeloid Plastic Precision Instruments

The Emeloid Co., Inc., Arlington, N. J., is making precision instruments, from slide rules up to the most complicated artillery and navigation charting and calculating instruments, from a plastic material known as "Emeloid." The Company employs processes to turn out instruments which are said to be light in weight and accurate without the use of precious metals or rare materials.

### Carbide Tool Grinders

A newly designed line of 10 in. and 14 in. Carbide Tool Grinders has just been brought out by Hammond Machinery Builders, Inc., Kalamazoo, Mich.

A coolant control feature enhances the facilities for properly flooding the tool while grinding wet, it is claimed. Fully adjustable coolant spouts with wide outlets permit flushing.



Hammond Carbide Tool Grinder

## Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

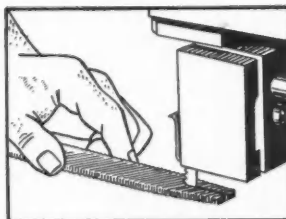
### Hard Steels Cut by Heat Generated by Super High Saw Speeds

Ordinary band-saws, when operated at unbelievable high speeds up to 12,000 feet per minute, cut through hard steels and alloys by heat generated from the friction of the saw against the metal to be cut. The cutting effect is more that of burning through the metal than actual cutting. The heat generated is sufficient to melt or burn out the metal in the saw cut but not enough to draw the temper on the sides.

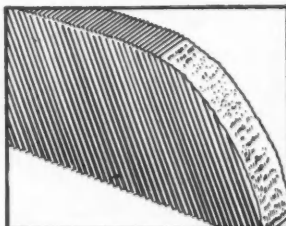
The hardness of either saw or metal to be cut is of little importance. Thin metal sheets are cut like paper, and plates up to one inch in thickness can be cut at speeds of ten inches per minute.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information about this method from Bell Aircraft Corporation, Buffalo, New York.



Proof of ability of new method to cut hard materials is demonstrated by operator cutting a file.



The temper of curve cut section shown above is unaffected.

X-60

# Lubeck

WITH ELECTRICAL EFFICIENCY

That's the Briete Strasse below. Once a busy street in Lubeck, Germany. More Americans are passing over . . . leaving behind impressive reminders that "he who lives by the sword, shall die by the sword!"

Our "persuasive" Americans make their calls in "Havocs"—the well-named Douglas A-20 Army attack bombers shown at left. With the aid of the latest developments from America's electrical laboratories, these and other great allied warplanes are leveling Lubeck and the rest of industrial Germany.

Holding our planes true on the bomb-run, and guiding them safely home are a whole host of Westinghouse products. These provide electrical power and control for such applications as wing flaps, trim tabs, fuel pumps, engine cowl actuators, landing gear and bomb doors.

On these vital electrical units, the fighting efficiency of the plane, its safety, and the pilot's life may well depend. Westinghouse builds them to operate dependably under all extremes of temperature, humidity and altitude, and under the severest flying conditions.

For help on electrical equipment for aircraft, consult Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania, Dept. 7-N.

J-03193



**SPECIAL DIRECT-CURRENT MOTORS**—perform many vital jobs—operating blowers, bomb bay doors, cowl flap actuators, fuel pumps. These motors are available in a complete line. They are built in standard sizes and ratings.

**DIRECT-CURRENT GENERATORS**—main engine driven to provide the large amount of power required by modern electrical equipment on multi-engined planes.



## Bendix-Westinghouse Produce Pneumatic Power Equipment

(Continued from page 21)

speed air spindle capable of a speed of 70,000 rpm., a Cincinnati cylindrical grinder, Ex-Cell-O thread grinder and cemented-carbide tool grinders, Oliver grinder designed for automatic profiling of milling cutters, and other items. Cemented-carbide tools are extensively employed on milling machine operations and on the precision boring operations on rods, cylinder heads, and blocks. The toolroom is provided with suitable items

of equipment for the form-grinding and maintenance of such tools.

An interesting feature of the self-contained machine shop departments is the use of flexible machinery and provision of interchangeable jigs and fixtures and tooling which make it possible to process many variations of connecting rods, crankshafts or slack adjusters over a specialized machine line.

Let us consider the steps in the ma-

chining of a number of typical parts. On the cylinder block line, the first operation is the milling of top and bottom faces in a Cincinnati Duplex Hydromatic milling machine. Cylinders then are rough-bored on a Natco B 225 H drill. Two end bosses and the center boss are milled in successive operations in Kent-Owens hand millers. Drilling and countersinking of a variety of holes is done on a Natco No. 813 drill, using special fixtures. Delta drills are employed for several single holes. The cylinders are diamond bored, then honed in a new hydraulic Barnes drill two-spindle honing machine fitted with Micromatic hones. On cylinder heads, there is a new Natco drill provided with five stations, handling the entire sequence of drilling operations in one setting.

The connecting rod and cap comes in as integral forging, suitably heat-treated. The forging is coined in a No. 666 Bliss press, then the sides are ground in a Blanchard surface grinder. Drilling, reaming, and chamfering are done in a 3AL Natco, chamfering of  $\frac{1}{8}$  in. holes being handled separately in Delta drills. The crankpin end of the rod is milled, handling two rods at a time, in a Sundstrand mill. It is degreased in a Detrex washing machine, then tinned and babbitted by casting. Following this operation, the cap is cut off in a Campbell abrasive cut-off saw. Both the large and small end of the rod are finally precision-bored in a two-head Heald Bore-Matic using cemented-carbide fly-cutters.

The compressor crankshaft is received as a rough forging, the ends being ground flat for centering. The forging then is centered, rough-turned completely in two operations in Lo-Swing Model LR lathes. The pins are turned in successive operations in LeBlond lathes. Pins and bearings are ground to precision tolerances in separate settings in Landis hydraulic grinders.

Production of the slack adjuster is interesting, although there is no sign of the dramatic since the operation has been mechanized to handle a variety of types and sizes in great volume. One of the interesting operations is the broaching of the large end to produce the bore and large slot simultaneously in one setting in a large horizontal La Pointe broaching machine. In the assembly department, the slack adjuster parts are pressed into an assembly on a new Hanna air press, prior to riveting on another machine. Worm gears for the slack adjusters are cut in Barber-Colman gear hobbors.

The final assembly department in the main plant is composed of groups of benches equipped for the assembly of specialized individual items such as relay valves, brake chambers, compressors, slack adjusters, governors, etc. It is of interest to note that many of these specialized lines are mechanized through the installation of suitable conveyor lines. For example, brake chamber assembly is handled on benches



### PROTECTS ALL PRODUCTS

Gun Parts and Assemblies; Aircraft Instruments and Parts; Plane Assemblies and Spare Parts; Shells; Cartridges; Flares; Rubber Products; Tank and Vehicle Supplies; Radio Equipment; and other Army—Navy—Lend Lease—Equipment and Supplies.

### FREE TECHNICAL DATA BULLETINS

Write for Adhesive Problem Data Sheet and Technical Bulletins describing PAISLEY War Packaging Adhesives.

### Check these features

Here are a few reasons why PAISLEY EXPORTEX WATER-PROOF GLUES are accepted by Procurement and Inspection Agencies, A. S. F. Depots and leading war plants in all industries.

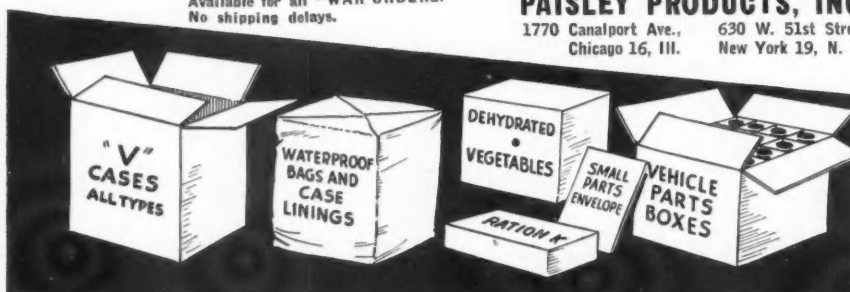
1. EXPORTEX provides almost instantaneous sealing of water-proof bags, case linings, asphalt laminated and impregnated wrappings.
2. EXPORTEX is ready to use. No heating. No messy solvents or mixing required.
3. EXPORTEX is easily applied to bag seams, lining overlaps and carton flaps by hand brushing or regular glue sealing machines.
4. EXPORTEX withstands many days of water immersion. Meets Export Packing Specifications with a wide margin of safety.

Wire, 'phone or write today, stating what and how you pack and ship, for complete prices and specific details.

Available for all "WAR ORDERS."  
No shipping delays.

### PAISLEY PRODUCTS, INC.

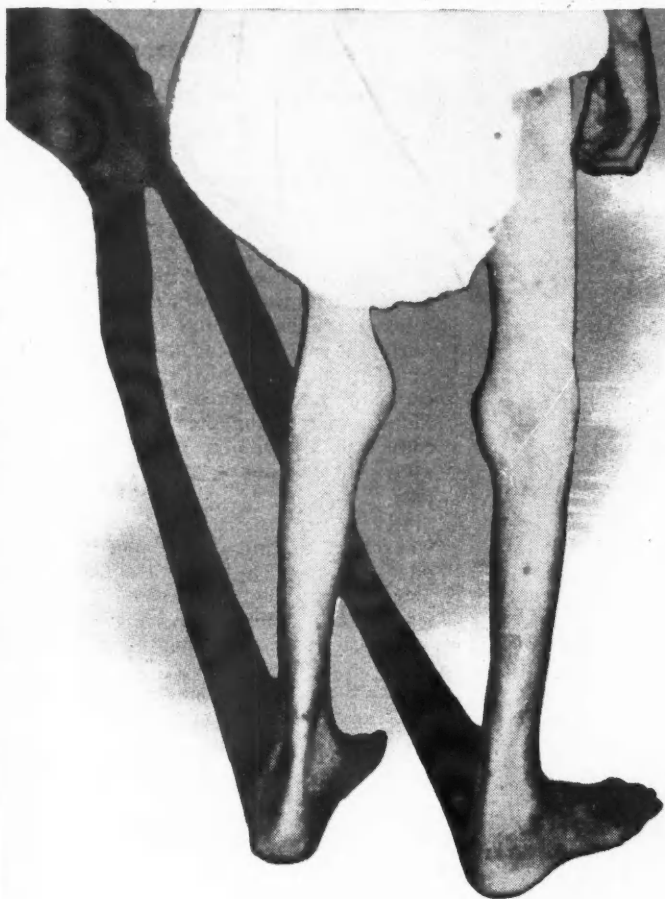
1770 Canalport Ave., Chicago 16, Ill. 630 W. 51st Street New York 19, N. Y.







What part will machine tools play in helping  
to feed this hungry belly?



Here stands a souvenir of War—a silent, implacable challenge to the meaning of our words . . . Here stands want.

A grim reminder that we must not waste food now—that we dare not complain—it also says, as no words could, that part of the victory we're fighting for can only be won with plowshares.

What part will machine tools play? The greatest part in history. For there is scarcely an essential to civilized living today that does not stem from a handful of basic precision machine tools . . . from the barest necessity, a loaf of bread, to the most intricate and wonderful machines which help men think, to search and to know.

And one of these machine tools—the internal grinding machine—is essential to the creation of literally everything that will make this world a better place in which to live, after this war is won.



**BRYANT CHUCKING GRINDER COMPANY**

SPRINGFIELD  
VERMONT, U.S.A.

served by a double-tier gravity roller conveyor section on which the assembly is moved along.

The foregoing has dealt primarily with some of the activity in the main plant. There is, in addition, the smaller building which is concerned essentially with screw machine work and press operations. The press shop contains the large Bliss press which is used for coining the connecting rod and for producing a variety of sheet metal stampings such as flanges, diaphragms, etc.; also a battery of knuckle presses for punching operations. The screw machine department is generously endowed with a battery of the well-known

Greenlee automatics capable of high precision, a battery of large Conomatics, and a battery of small Brown & Sharpe automatics. Output of this department supplements the variety of screw machine parts procured from outside vendors.

A major activity in this plant is the "returned material department" which is concerned with the re-building and repairing of units replaced in service. This department normally serves the needs of the armed services as well as those of fleet operators who keep the wheels of our war-time economy turning without interruption. On a small scale this department is a prototype

of the main manufacturing plant in many respects.

When assemblies are received here they are torn down completely and each part is cleaned in a Detrex alkaline washing machine for examination. Such major parts as can be reconditioned are suitably processed. For example, compressor cylinders are honed to oversize in a Barnesdrill single-spindle honing machine fitted with Micromatic hones, valves are re-ground, etc. These salvaged parts then go to the small assembly benches where the units are assembled, using new or re-conditioned parts. The completed units are made the equal of new units as to performance and life (but sold only for exchange purposes) and are subjected to the same quality controls and final testing as are the new assemblies.

The plant shows the benefit of recent construction by the installation of a system of Bulldog bus duct for carrying all power wiring to the production equipment throughout both buildings.

Considering that B-W is a specialist in pneumatic devices, it is of interest to note that the majority of work-holding fixtures throughout the machine shops and assembly departments are air-controlled. Wherever feasible the parts are air clamped and air indexed.

## Recent Developments In Powder Metallurgy

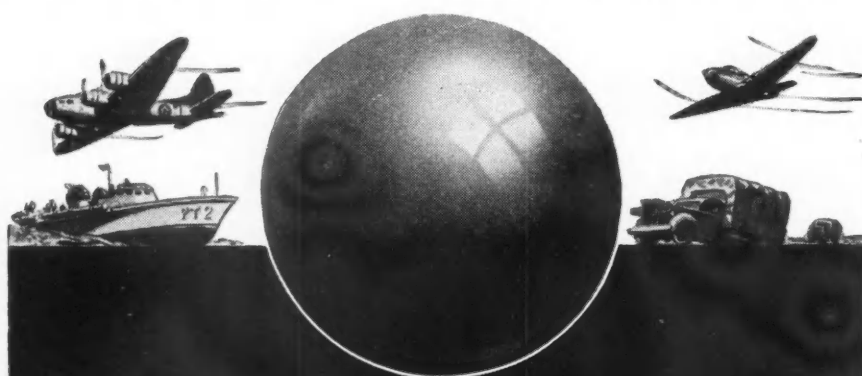
With the increasing knowledge and experience in the field of powder metallurgy not only are applications being expanded but new types of metal powders are being explored both experimentally and in production.

Recent developments include the production of brass powders and copper alloy powders having properties superior to such materials as produced by conventional mill methods. One company has produced a heat treated aluminum powder compact, replacing conventional type A 17 S aluminum alloy, with ultimate strength of 40,000 psi.

Others are carrying on experimental work with stainless steel powder compacts and with high carbon steel powders capable of hardening treatment after molding. Among the new applications there appears the possibility of producing certain light weight aircraft mechanical parts by powder metallurgy, using aluminum and magnesium alloy powders.

It has been found that aluminum alloys are difficult to handle due to the galling of dies. Experimental work now indicates the feasibility of producing aluminum compacts by hot pressing, using cemented-carbide dies.

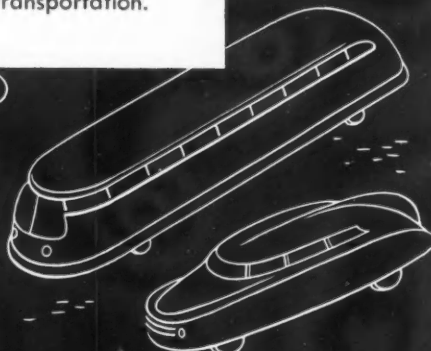
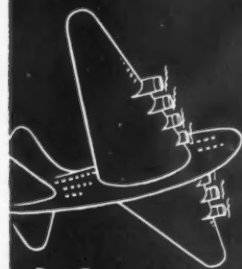
In the production of powdered iron cores for magnetic circuits, a prominent laboratory reports that the addition of only 5 per cent of carbonyl iron to an ordinary cheap iron powder improves physical properties and quality materially and aids in reducing the cost of acceptable quality cores.



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Largest independent and exclusive metal ball manufacturer

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## STEEL BALL CO.

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## Reduction of Assembly Time

(Continued from page 37)

of lack of an adequate procedure to bring such cases to light and to secure correction of the cause. Frequently lack of action may result from the fact that careful investigation is necessary to determine the true reason for the difficulty. This, coupled with a willingness at times on the part of subordinate personnel to continue an inefficient operation because it is the line of least resistance, further accounts for lack of effective corrective action. Such conditions are frequently hard to eliminate because of the difficulty of determining departmental responsibility or because a deadlock may occur due to the responsibility being divided between two or more departments. These situations can be effectively handled by competent industrial engineers assigned to specific plant areas, who bring to the attention of the departments involved cases resulting in "non-standard" shop operations. Where these appear to be the responsibility of Engineering, they are assigned to the Project Production Design Engineer who makes a thorough investigation. If he finds that the difficulty involves other departments than Engineering, he sees that they are given the information for appropriate action. If Engineering only is concerned, he brings the matter to the attention of the project office. This arrangement to take care of the more involved cases which cannot be readily handled through normal channels, has operated for some time and been instrumental in smoothing out many production difficulties, particularly those affecting both Engineering and Tooling.

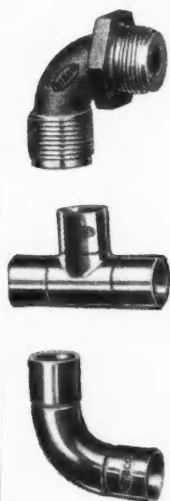
It has been our experience that when the obvious tooling and engineering errors have been corrected, there remain further troubles which may be serious and account for a great deal of hand tailoring or unnecessary expenditure of assembly time. These, in large part, are due to failure on the part of a design engineer to anticipate design conditions that will result in inconsistency of manufacture. Inability to recognize such conditions, and then to make the necessary changes in design to provide for manufacturing consistency, usually results in continuance of the trouble. Such difficulties result, in large part, from failure to provide properly for an accumulation of tolerances in major assemblies as these affect the relationship of one major assembly to another.

There are a number of examples of this type. Cowlings, fairings, fillets, and similar parts should not be fastened across the attaching joints of main assemblies, the locations of which may vary considerably. If such fastening is necessary, sufficiently enlarged or elongated holes must be provided; otherwise the tooling problem becomes impracticable and there is continual difficulty. Interesting examples of parts requiring the incorporation of adjust-

ment are close-fitting ducts (see Fig. 7) and exhaust manifolds which extend from one main assembly to another. Prior to the introduction of adjustment in the mounting brackets for such ducts, we experienced continual trouble due to the build-up of tolerances. Self-aligning pulleys or adjustable pulley brackets afford an example; the use of radial serrations for bell crank or control levers is another illustration. A frequent means for providing necessary self-alignment is a threaded strut

end. It may be noted that provision for adjustment when this is not needed is unnecessary cost and weight. It must be emphasized that intelligent and correct tooling is required if hand tailoring is to be avoided and if the possibilities offered by proper and intelligent design are to be fully utilized.

A careful study of tolerances and provision for the widest permissible tolerances is of great assistance to production in avoiding annoying interferences or non-standard and unplanned assembly operations. Where tolerances in critical places are left to the judgment of subordinate personnel, instead of being given attention by thoroughly com-



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He fought against great odds for the next year or two. One plane against three . . . ten against forty. And he did all right, too.

Today those odds against him have been greatly reduced as planes in ever-mounting thousands roll off America's production lines. Acme men and women are happy that they've made some contribution to the plane this man flies and to the equipment he's got.

They are proud of the part they are playing in producing for victory, because whether it's patterns, dies, heat-treated aluminum castings, or specially engineered tools needed by war plants, Acme production is keyed to the slogan "Acme for Action."

**ACME PATTERN & TOOL COMPANY, Inc.**  
**DAYTON, OHIO**

Heat-Treated Aluminum Castings—Patterns—  
Tools—Tool Designing—Production Processing



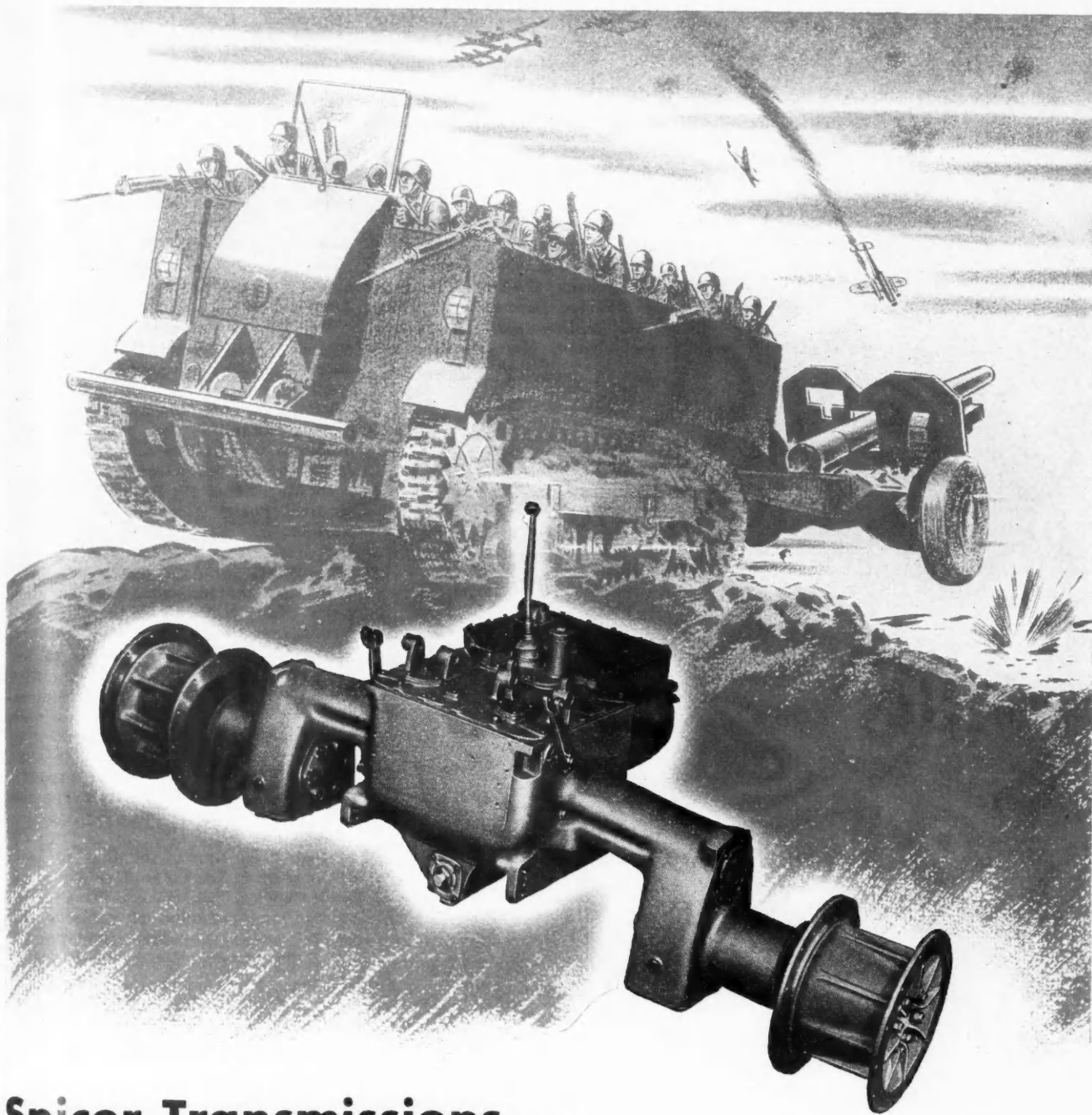
Army-Navy "E" Award received Jan. 12, 1943. White Star for Continued High Production Achievement awarded October 30, 1943.

petent production engineers and senior designers, both fabricating and assembly operations may be unnecessarily expensive.

The report on dimensional integrity from the Consolidated Aircraft Corp. mentions one important detail that is frequently the cause for unjustified hand tailoring; namely, the use of butt fits, in sheet metal work particularly. Where these cannot be eliminated, such joints should always be shown on a drawing by two lines, and we have found it advisable to issue a Process Specification giving permissible gaps between sheet edges for screw joints and riveted joints. For critical portions of the structure, such as the leading edge of the wing, such tolerances are closer than in cases where aerodynamic considerations are of less consequence.

Somewhat over a year ago we adopted the policy of having a small group of experienced tooling personnel stationed in the Engineering Department during the development of a design. These tool planners cooperate with our production engineers in determining the breakdown of the airplane; in deciding where means should be provided for adjustment or self-alignment; and in determining what parts should be rendered interchangeable from the point of view of manufacturing advantage. We have also adopted the policy of having our production engineers decide which parts must be interchangeable from the standpoint of spares. Such requirements are mandatory for tool planning. The tool planners in Engineering prepare basic tool plans which are then transmitted to the Production Tool Planning and Design Departments and form the basis for their detail work. It is our opinion, based on experience, that this procedure is decidedly helpful in production of intelligent tooling and design and, therefore, in reducing hand tailoring operations on assembly.

Somewhat related to design and tooling, but illustrating another phase in which they affect hand operations, has been our work on the elimination of as much SO forming as possible and conversion of tools so that parts could be formed in the ST condition. Likewise, we have been able to substitute 61SW material in cases where strength considerations permitted and where 24S material could not be formed in the ST condition. Such changes eliminated distortion in heat treatment, with consequent hand operations. Likewise, we have eliminated troublesome problems in springback by forming extrusions and pre-formed sheet metal sections through the process of stretching, an operation which, where possible, is much simpler, aside from springback difficulties. The use of the double-acting press and the application of the stretching principle have been effective means for forming many sheet metal parts in the ST instead of the SO condition.



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The Army Field Artillery's new weapon . . . the M-5 High Speed Tractor, weighing 13 tons and pulling a 7½ ton Howitzer at speeds up to 35 m. p. h. . . . uses a massive Spicer Transmission capable of withstanding the most extreme punishment of battlefield service. This is another example of how Spicer experience and manufacturing facilities met emergency wartime needs. These same facilities for producing Spicer automotive transmissions, universal joints and axles will be ready for immediate peacetime demands when war production has stopped. Spicer Manufacturing Corporation, Toledo, Ohio.



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December 1, 1943

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71

## New Aircraft Standards Adopted by N.A.S.C.

The adoption of new standards and specifications which will simplify design, assembly and maintenance of U. S. government air planes all over the world were announced by the National Aircraft Standards Committee of the prime airframe contractors to the U. S. Government at the conclusion of its three day sixth national meeting at the Hotel Lexington.

In addition to more than 40 representatives of the 32 contractors for design and production of government air-

planes, the meeting was attended by members of the Army-Navy Aeronautical Board, the Bureau of Aeronautics of the U. S. Navy, the Wright Field staff of the U. S. Army, the War Production Board, the American Standards Association, the British Air Commission, the Royal Canadian Air Force and the Australian Office of War Supplies.

New officers of the association for 1943-44, elected are: National chairman, Jack F. Cox (Vega, Burbank); Eastern Division chairman, George W. Baughman (Cessna, Wichita); Western chairman, Charles Sardou, Jr., (Consolidated-Vultee, Downey, Calif.); Eastern vice-chairman, Jerome Gropper

(Brewster, Hatboro, Pa.); Western vice-chairman, Glen Aron (Northrop, Hawthorne, Calif.).

The retiring national chairman, Eric Dudley, materials and standards engineer for Curtiss-Wright, Buffalo, announced that the meeting had approved the progress report of his sub-committee for the reduction of varieties of sizes, thicknesses and tolerances for carbon, alloy and stainless steels in sheet, plate and bar form to approximately one-seventh of their former number. This project is now nearly complete.

Mr. Dudley revealed that the committee now in its third year, has produced from 50 to 75 new standards and specifications per year, which have been officially adopted, and all of which will greatly simplify the raw materials problems of airplane designers, manufacturers and purchasers.

He stated that the Army-Navy Aeronautical Board is giving the National Aeronautical Standards Committee increasing responsibility in the preparation of data for Army-Navy standards, which are the highest in the aviation world. Many N.A.S.C. standards become Army-Navy standards.

Among the accomplishments of the National Aircraft Standards Committee during the past year, it was announced, was the reduction of the 2700 varieties of dural tubing materials and sizes to 325, a corresponding reduction in steel tubing and the cutting of the approximately 100 varieties of rivet types and materials used in airplane construction to less than 10.

Most of the time of the final full two-day session of the Committee was devoted to review and consideration of its more than one hundred projects and project surveys covering standards for every department of airplane design.

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SIGNAL INDICATION  
Shock Resisting! Vibration Proof!  
A LITTELFUSE  
EXCLUSIVE**



**Littelfuse SIGNALLETTE**

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Most rugged construction; eliminates burn-outs; no need of spares; positive indication in bright sunlight, any light, or total darkness; instant adaptation to airman's eyes from cockpit to target; dynamically balanced, withstands vibration to 10 G, and 700,000 cycles of operation; saves  $\frac{1}{2}$  current; unaffected by temperatures  $-85^{\circ}$  F. to  $160^{\circ}$  F.; 4 signal colors: Red, green, amber, white; fits  $\frac{5}{8}$ " standard lamp mounting AC42-B3593.

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"BOMBS AWAY"

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## Glass Overcoats for Storage Batteries

Glass overcoats are keeping storage batteries in working order in Army motorized equipment operating on the Alaska Highway and in the Aleutians.

To prevent battery solutions from freezing when the temperature falls as low as 40 below zero, Mid-West Fiberglass Fabricators, Detroit, Mich., is insulating the steel-box battery holders with one-half-thick boards composed of bonded glass fibers. The insulated boxes are shipped to the motor manufacturer for installation on Army vehicles.

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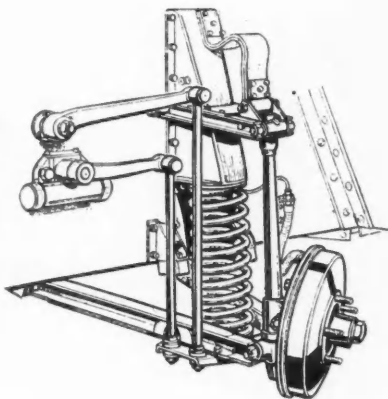


## Morris Armored Car With Frameless Chassis

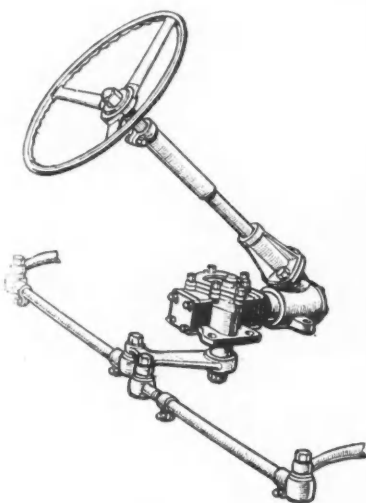
(Continued from page 33)

pendent springing at the front. The latter at each side comprises a long triangular link, just below the center line of the wheel, hinged at its base to the center of the body structure. The apex of this link carries the knuckle joint of the steering and from this rises a long tapered king-pin, the upper end of which is linked to a bracket attached to the side of the body. The same bracket provides the upper abutment for a

*Independent front suspension of Morris armored car. A point of note is the length of the king-pin between the upper and lower links or "wishbones".*  
(Courtesy Auto-car, London)



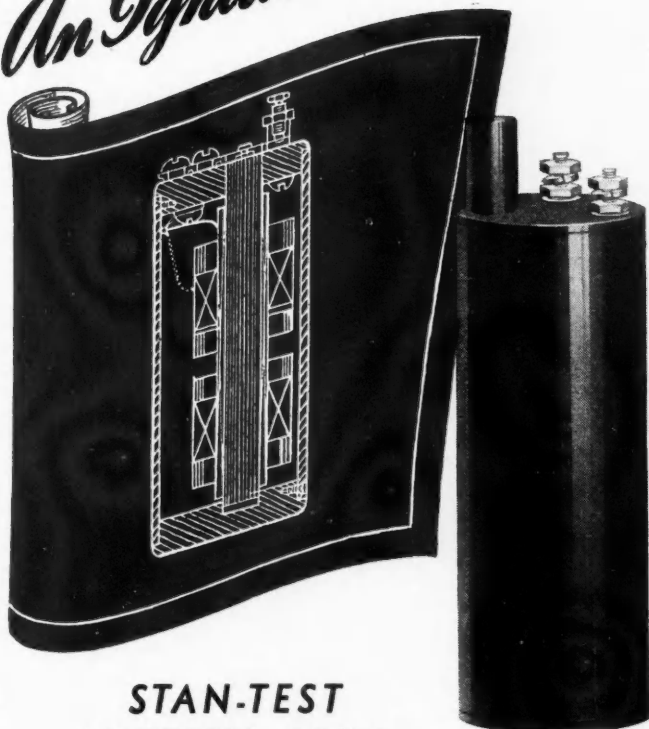
helical spring, the lower end of which bears upon the apex of the main link. In brief, the front suspension is of the "wishbone" type with helical springs. Also attached to the main link are two vertical rods, one coupled to the Luvax piston type shock absorber and the other to a lever on an anti-roll torsion bar extending across to a corresponding level on the other side of the body. Brakes are hydraulically operated through a tandem master cylinder.



*Layout of steering on Morris armored car. Bevel gearing at the bottom of the column transmits motion to a cam gear above it.*  
(Courtesy Auto-car, London)

The wheelbase is 98 in.; front and rear tracks are respectively 60 $\frac{1}{8}$  in. and 63 $\frac{1}{8}$  in.; overall length 13 ft. 3 $\frac{1}{2}$  in.; height 6 ft. 2 in., minimum turning circle 34 to 36 ft, wheel size 16x6.00 in. and tire section 9.25 in. The fuel tank capacity is 17 $\frac{1}{2}$  U. S. gal.

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"Unbrako" Internal Wrenching Bolts are being manufactured by our largest and best equipped department, where only the most highly skilled workers experienced in making precision aircraft engine parts are employed. The bolts are extremely accurate, being made to unusually close tolerances. They are now being used by some of the largest aircraft manufacturers.

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Because the "Unbrako" Wrenching Bolt is applied with an *internal* wrench, it can be jammed right into tight places as could never be done with the ordinary hex head bolts requiring a bulky external wrench to apply. The "Unbrako", therefore, saves space, material and weight—greatly facilitates compact designs.

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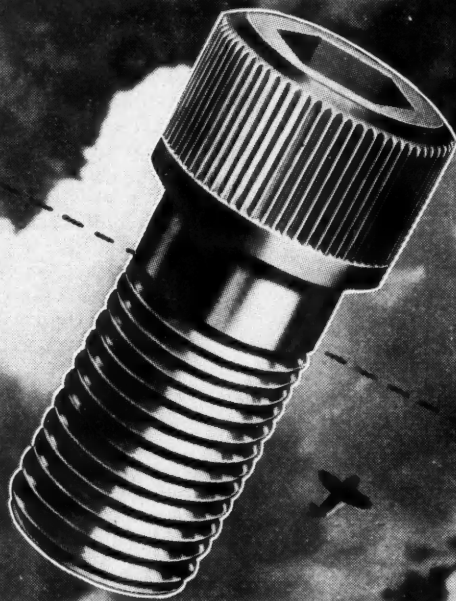


# PRECISION MADE

## UNBRAKO

### KNURLED SOCKET HEAD CAP SCREWS

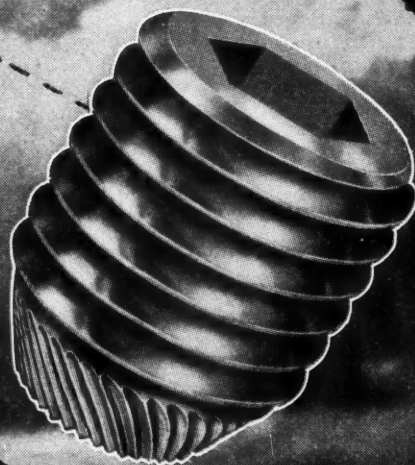
The knurled heads prevent time-wasting finger slip and lost motion—help speed production. Knurling also permits locking after countersinking. Sizes: No. 4 to 1½" diameter.



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### SELF-LOCKING HOLLOW SET SCREWS WITH THE KNURLED POINTS

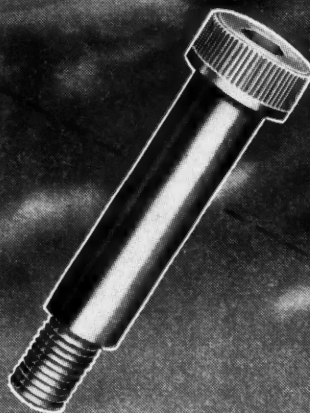
Maintenance, time and money savers. When tightened as usual, the knurls dig in and lock the screws in place so they positively won't work loose under vibration. Sizes: No. 4 to 1½" diameter.



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with accurately ground bodies. Available with knurled heads, as shown. Great variety of sizes immediately available from stock.



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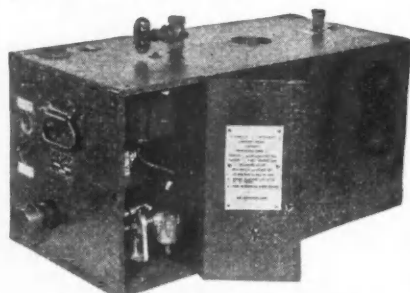


# HUNTER HEATERS MADE FOR RAPID WATER HEATING

## Automatic Gasoline Burning Models Designed for Mobile Service Units

CLEVELAND, OHIO—A gasoline burning water heater that will supply water at high temperature, and that is capable of automatically maintaining a continuous supply, has been perfected by Hunter and Company of this city, makers of Hunter Universal Gasoline space heaters.

Two models are at present available. One is a portable unit with a ten-gallon pressure tank that is suitable for connection to any permanent or emergency water supply. It is completely automatic. The other is a five-gallon unit with a gravity type tank, designed to heat small quantities of water in a hurry. This heater is meant to be permanently installed in any kind of mobile service unit where there is frequent need for hot water. It fastens to a wall, and may be filled through an opening in the top, or connected to a hand pump or to a pressure water system.



*Hunter Automatic Water Heater*

In both models, the heating element is a Hunter Universal Gasoline Burner, with "Sealed in Steel" flame, adapted as an immersion unit. The steel tube burner, with its terrific heating capacity, is immersed deep in the liquid to be heated. Unusual results are obtained in speed of heating and flexibility of automatic control. The same principle has been used by Hunter in special applications in storage or shipping tanks to protect oil or other fluids against cold.

These advantages, combined with the fact that the Hunter burner operates on any kind of gasoline, from truck fuel to highest octane, give Hunter Water Heaters an almost unlimited range of usefulness in mobile photographic, laboratory or hospital units, in field service units of all kinds . . . anywhere it is desirable to have an extremely simple and effective means to supply hot water.

More complete details about Hunter Water Heaters and their application may be obtained from Hunter and Company, 1552 E. 17th St., Cleveland, Ohio.

*(Advertisement)*

## Union-Management at Willow Run

*(Continued from page 48)*

of that resolution states, "That in those plants where management is not bargaining in good faith and is taking advantage of the war situation and labor's no-strike pledge to destroy collective bargaining, the international executive board shall in order to insure continuous production demand government operation of such plants, under the war powers of the president and not under the Smith Connally Act and with full guarantees of all collective bargaining rights for the workers in the plants and with elimination of all profits to the employers."

Officers of Local 50 of the UAW-CIO denied the company's charges and stated they merely proposed the plant be run by a joint committee made up of representatives of the company, the Army and the bomber workers, or that it be run solely by the government.

New officers of the local have been attacking the plant's operating efficiency ever since they were elected last summer, which brought a company rejoinder that their election did not qualify the new union officers as production experts. The two-day wildcat strike was staged by die setters and press operators who demanded a five-cent per hour raise to eliminate a differential that existed in their classification with other Ford plants in the area. The request was referred to the Michigan Regional WLB after the men agreed to return to work. Appointment of Col. August M. Krech, who retired Sept. 1 as commanding officer of the Sixth Service Command in the Detroit area, as labor relations director at Willow Run also was expected to restore harmony. Col. Krech succeeds John Ringwald, a former union organizer who aroused some antipathy among his one-time compatriots in the UAW-CIO. Local 50 officers expressed the hope that Col. Krech's appointment meant that Ford has decided to use "less sandpaper and more silk in its labor relations." They also pledged him their cooperation in improving labor relations and reducing labor turnover and absenteeism.

Labor trouble also beset the Ford Rouge plant, where three unauthorized work stoppages by 4,000 workers in the production foundry were culminated when steel castings were thrown through the windows of the superintendent's office and four supervisors were threatened. The workers walked out in protest when an employee was fired after a fight with a foreman while the foreman urged the men to go back to their jobs and the dispute was referred to normal grievance procedure. There also was a 12-hour strike of 1,200 machinists and gear grinders at the Ford Highland Park plant who protested WLB delay over a petition for a 15 to 20-cent hourly pay raise to eliminate rate differentials with the Rouge plant and a walk-

out of four metal pourers in the Ford aluminum foundry, seeking a five-cent per hour wage raise, made 500 other workers idle for two days.

Making maximum use of existing hiring channels without requiring controlled referral of all workers in 149 critical occupations through the U. S. Employment Service, the Detroit Area WMC finally had its employment stabilization plan approved by the Regional WMC and it took effect Dec. 1, a month and a half after the deadline that had been set by Paul McNutt, National director of WMC. Private employers, labor and employer hiring halls, professional organizations, schools and colleges, technical institutions and government agencies, after they have complied with WMC standards, are empowered to hire directly or refer workers who otherwise would be hired only upon referral by USES. This encourages local initiative and cooperative effort without embracing the compulsory features of the Buffalo and West Coast manpower programs.

In-migrant workers must have a statement of inter-area clearance or be referred through the USES to qualify for Detroit area employment. Resident workers must have a statement of availability from their previous employers if they have held an essential job in the preceding 60 days, in order to take a new job. A statement of availability can be obtained if a worker is laid off for seven or more consecutive days, if he is employed at sub-standard wages, or for compelling personal reasons. An employee may change his employment and still maintain his seniority if he is competent to perform a higher skill than that at which he is employed, where he is working less than full time (48 hours weekly) for a substantial period or where his transfer is requested by WMC. However, the original employer is given five days to determine if he can meet the requirements of the new employment. The plan was worked out by a joint labor-management committee of the WMC.

A manpower priorities committee is set up under the new program to list comparative urgencies of production and essential civilian services so that new workers can be channeled to those jobs. This balancing of production with manpower is done in cooperation with the WPB production urgency committee, whose chairman is Edward T. Gushee, assistant to the president of the Detroit Edison Co. The production urgency committee is empowered to review all production schedules, contracts and proposals for new facilities, making recommendations for curtailment of less essential production and adjustment of civilian production and services. Employment ceilings to discourage labor hoarding also are set by the manpower priorities committee.

## Business in Brief

Written by the Guaranty Trust Co.,  
New York, Exclusively for AUTO-  
MOTIVE AND AVIATION INDUSTRIES

Fluctuations of general business activity at levels somewhat below the September peak have continued. The seasonally adjusted index of the New York Times for the first week of November stands at 136.9, as against 139.1 for the preceding week and 131.2 a year ago.

Retail trade has begun to reflect the stimulus of the approaching holiday season. Department store sales reported by the Federal Reserve Board for the week ended November 6 were 10 per cent above the corresponding amount last year. For the period of four weeks ended, the similar gain was 11 per cent; and sales in 1943 to date were 13 per cent greater than the comparable total in 1942.

Railway freight loadings during the week ended November 6, under the influence of holiday observance, totaled 754,724 cars, 14.6 per cent fewer than in the preceding week and 9.0 per cent below the corresponding number last year.

Electric power production increased more than seasonally in the second week of November and was 18.7 per cent larger than the output a year ago, as compared with a similar gain of 17.3 per cent recorded a week earlier.

Crude oil production during the same period, reaching a new peak, averaged 4,436,450 barrels daily, 27,200 barrels above the figure for the preceding week and 59,750 barrels more than the average recommended by the Petroleum Administration for War.

Bituminous coal production in the week ended November 6 dropped to an average of 465,000 tons a day, as against 1,897,000 tons in the week before and 1,860,000 tons a year ago.

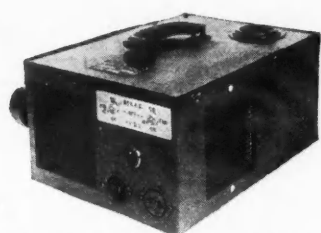
Engineering construction contracts awarded during the week ended November 11 totaled \$62,972,000, according to *Engineering News-Record*, as compared with \$35,206,000 in the preceding week and \$304,221,000 in the corresponding period last year. The figure for private construction, \$16,607,000, is more than double the comparable sum in 1942.

Professor Fisher's index of wholesale commodity prices for the week ended November 12 stands essentially unchanged at 111.1 per cent of the 1926 average, as compared with 108.5 a year ago.

Member bank reserves increased \$129,000,000 during the week ended November 10, and excess reserves remained at an estimated total of \$1,080,000,000. Business loans of reporting member banks declined \$7,000,000 in the same period and stood \$167,000,000 below the total a year earlier.

## Willow Run Has Built 1000 B-24 Bombers

More than 1000 B-24 Liberator bombers have been flown away from Willow Run in the last year, the Ford Motor Co. has announced, with approval of the War Dept. This does not include substantial additional numbers shipped in knocked down sets for final assembly elsewhere. The next thousand will come along a lot faster, according to the company.

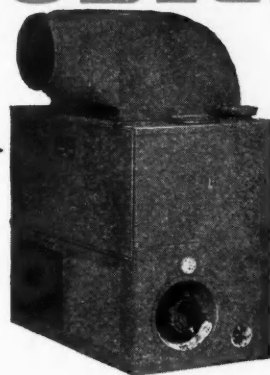


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truck fuel to  
100 octane!**

**Uses for Hunter Universal Gasoline Heaters are too widespread and varied to list completely, and are multiplied daily by the imagination and ingenuity of men who build, buy or command equipment for the service or supply of our armed forces, or essential civilian activities.**

**We build a variety of small, powerful units, each with a range of applications to which it is especially suited. YOUR heating problem may be one of these, or it may be one on which Hunter heating engineers can assist you in applying the extremely flexible basic units of Hunter Heaters to do exactly the job you need done. In either event, we shall be glad to furnish further information specific to your particular interests.**

BULLETIN HB-3

ON REQUEST

# HUNTER AND COMPANY

**Aircraft Equipment**

**1552 E. 17th St.**

**CLEVELAND • OHIO**



## Air Cargo Problems

(Continued from page 41)

transportation, arise out of the fact that while aircraft are the most flexible transportation conveyances known while in the air, they are one of the least flexible when on the ground. Thus, Dr. John H. Frederick, professor of transportation, The University of Texas, opened his paper entitled "Coordinating Air and Surface Cargo Transportation."

The author went on to state that commercial air transportation, par-

ticularly air cargo transportation, is now at the point where its continued development can be seriously handicapped by lack of airport planning. Much of the airport construction of the past few years has been with military or strategic ends in mind, rather than commercial use.

In speaking of cargo handling, Dr. Frederick looks forward to more handling of cargo within an air terminal than has been necessary for ground

transportation terminals. For example, if aircraft were docked alongside a warehouse, cargo would have to be moved a distance of approximately half the span of the wing or about 100 feet, thus calling for powered conveyor belts or tracks or for non-powered roller conveyors to move the cargo with a minimum of effort or delay. Also, it will be desirable to have cargo for particular trips arranged in bins or containers for transfer by means of lift trucks. Pre-planning at the terminals will have cargo in sequence according to the loading plan of a plane. It will also be desirable to have all small packages destined to one place baled or bundled to obtain the economies always present when the size of the handling unit is increased. As long as cargo has to be brought to the aircraft instead of the aircraft going to the cargo, there will be problems of handling to overcome.

### Importance of Delivery Service

As to pick-up and delivery service the speaker said that a delivery service will have to be offered or else some method of notifying consignees of the arrival of a shipment will have to be developed. Any arrangements made either by telephoning or by mailing the notice of arrival would be cumbersome and costly, and the latter method would take too much time, thus sacrificing the advantage of speed. Since air shipments will be arriving at all times of the day, it will usually be inconvenient for consignees to be constantly dispatching a truck to pick up incoming shipments or else sacrifice some of the advantages of speedy long-haul service. If a delivery service is provided, pick-up service superimposed upon it would not be too expensive.

Air cargo development in general will come first in the field of long range movement and at a later date the short haul traffic may come into its own, was the opinion of E. J. Foley, assistant to vice president - Engineering, American Airlines, Inc., His paper "The Characteristics of Air Cargo Transportation" was a prepared discussion of Dr. Frederick's paper.

Mr. Foley said that the factors which rendered cargo appropriate or inappropriate for air transportation have been given much study in the recent past and more well-rounded criteria than the old high value-low weight ratio have been developed. He mentioned four factors. First, if the product is of a perishable kind, affected by style trends or subject to obsolescence and depreciation, or represents the high value per pound, the time saving inherent in air cargo can provide real economy to the shipper. Second, in certain lines the speed of air cargo can accelerate the volume of business in terms of turn-over and thus secure additional economies for the producer. Third, it is evident that if the dealer, without extensively increasing his



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STEEL**

From Atlas in the Army  
and Navy's greatest bombers  
softens up the tough spots in  
Axis resistance and makes  
the way easier for Allied  
armies all over the world.

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LANSING, MICHIGAN

**ATLAS**  
DROP FORGINGS



# "That Yankee gun they load on Sunday for the rest of the Week!"



These cynical and war-weary words were a Confederate soldier's description of a famous weapon of the Civil War. It was the Henry Rifle — a Yankee answer to a national emergency, back in the days of muzzle-loaders.

Benjamin Tyler Henry, the gun's inventor, was considered one of the greatest gunsmiths of the 19th century, and he helped to found the fame of Jones & Lamson in the early days of American industry . . . while the gun, in turn, commenced the fame of a great American company as the first of the world-famous line of Winchester Repeating Rifles.

\* \* \*

It was on a Sunday that America looked up from the tragedy of Pearl Harbor and asked her industries for a Yankee gun — Today, Jones & Lamson machine tools and engineering are again helping to produce many Yankee guns such as this world has never seen before.

And after the war is over, our engineers and service men will play an equally important part in helping industry to convert to peacetime production . . . when new companies and products will once more stem from the men and the machines of America's oldest machine tool company. Call upon Jones & Lamson, now!



## JONES & LAMSON

Universal Turret Lathes . Fay Automatic Lathes . Automatic Thread Grinders . Optical Comparators . Automatic Opening Threading Dies

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*Profit-producing Machine Tools*

capital requirements, can do a larger amount of business by virtue of air cargo shipments, another advantage is realized. Finally, if air cargo rates are excluded from immediate consideration, shipping costs may be reduced through lightened packing and reduced handling, carting, re-shipments, etc.

The speaker also mentioned that unless dependability of service can be maintained in cargo operation it is evident that much of its advantage will be sacrificed. Radio and navigation equipment are necessary to the extent of providing a high operational factor. De-icing equipment on the all-cargo

craft, another factor of operation dependability, should certainly be of the very best type available, equal in all respects to whatever might be provided in passenger aircraft. The potential abuses to which an all-cargo aircraft may be subjected highlighted the necessity for much design construction of maintenance facilities and general simplicity and accessibility. The airplane must attain a "work horse" ability through functional design, said Mr. Foley.

### Helicopter Problems

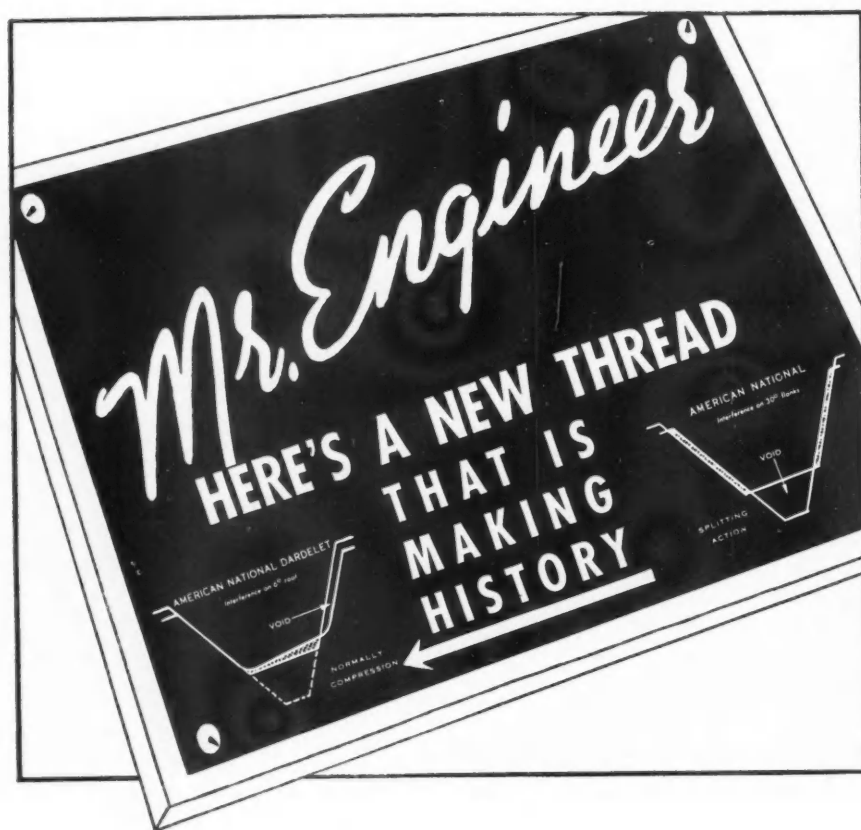
In the absence of W. B. Stout, President of the Stout Research Labora-

tories, Waldo Waterman, associated with Mr. Stout, talked on "The Helicopter and Direct Lift Craft." He stated that to date the press has built up in the minds of the public a fanciful picture of this type craft which does not as yet parallel the thinking of those experimenting with helicopters. It was Mr. Waterman's thought that the status of the helicopter at present is where the airplane was in about 1905. Much remains to be done and we must not look upon it as being merely a fuselage with a "pin wheel" stuck on top of it.

The speaker mentioned some of the complex problems involved in helicopter design. There is a definite weight limit which a single rotor will sustain. Means must be provided to counteract the tendency of a single rotor to rotate the fuselage about a vertical axis. While this is overcome in some designs by an anti-torque rotor (used for steering also) it means additional shafts and gears.

Furthermore, the application of two rotors revolving about a common axis in opposite directions, while overcoming torque effect, further complicates design. In addition, it is desirable to impart a sort of crawl motion to the individual blade of the rotor and naturally this calls for additional mechanism. The problem of de-icing presents itself, too, and this, said Mr. Waterman, is vastly more complicated than with conventional aircraft. Just how the rotors of a helicopter can be heated for de-icing constitutes a problem which the speaker literally tossed into the laps of those present for a solution.

It was Mr. Waterman's belief, however, that the helicopter has and will continue to have a definite place in future air transportation. It is significant, he said, that concerns like Bell, Sikorsky and others are doing development work on helicopter and direct lift craft and some good designs should be forthcoming in the next few years.



## STUD TROUBLE?

The American National Dardelet stud can be produced with minimum tool and gage alteration and incorporates the following advantages:

- Eliminates lateral motion which results in fretting in service.
- Overcomes galling during stud assembly.
- Reduces the necessity of selective fits.
- Seals against leakage through the thread fastening.
- Greatly increases resistance to fatigue.
- Increases strength in tension and torsion.
- Is economical in production — Inspection simplified.
- Can be driven into an A.N. tapped hole after reaming.

A.N. form + Dardelet = A.N.D.

**DARDELET THREADLOCK CORPORATION**  
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## Two Ammunition Plants Relinquished

Increased efficiency in the manufacture of small arms ammunition has reached the point where the Ordnance Department, Army Service Forces, has been able to relinquish two ordnance plants to fill another vital war need, according to an announcement by the War Department.

The United States Rubber Company will replace small arms ammunition production with the manufacture of synthetic rubber tires at the Eau Claire Ordnance Plant, Eau Claire, Wis. The Kelly Springfield Company also gradually is converting the Allegany Ordnance plant at Cumberland, Md., from the manufacture of small arms to rubber tire production.

# Manpower Shortage in the Bearing Industry

(Continued from page 17)

engines in 3 1/4 years. Thus the aircraft bearing demand has pyramided. Biggest pre-war aircraft engine production in recent years was 10,355 in 1939. That is less than a month's output today.

Use of bearings in other parts of the airplane besides the engine is tremendous. The propellers, landing gear, flight controls, and armament all employ many bearings. Needle bearings are used in the pulleys and universal joints. The turrets, gun installations and bomb releases all need bearings to insure smooth operation. The Norden bombsight employs 61 bearings. Aircraft instruments use bearings to insure accurate readings. This is true of servo units, automatic pilots, gyrocompasses and tachometers. Some of these tiny instrument bearings are only 1 mm. in diameter and weigh 1/7000th of an ounce. The fire control system alone on the new B-29 bomber requires 1417 bearings. An automatic pilot uses 45 bearings. One bearing company supplies 210 types of bearings to 54 instrument makers. Bearings also are used extensively in the airframe, in hinges, rod ends, bellcranks and push rods. However, some effort is being made to substitute bushings for bearings wherever practicable.

Many aircraft bearings require greater manufacturing time due to the close tolerances, fine finishes and many inspections that are requisite. An endeavor is being made to reduce these tolerances and finishes where it can be accomplished without compromising the safety and performance of the plane or engine. Silver-lined bearings for one type of aircraft engine cost \$350 per set, illustrative of the time and material that go into some of the industry's war products. All this takes more man-hours than the peacetime automotive bearings and man-hours are a dwindling commodity these days.

The Navy also is a large user of bearings. More than 13,000 landing craft have been built for the Navy to carry on its amphibious operations. Each of these landing craft is equipped with bilge pump, water pump and fire pump as well as the marine power plant and other auxiliary equipment. Bearings are required for all these units. Searchlights require 70 bearings and ship compasses 11.

Anti-aircraft fire control equipment and gun directors also use innumerable bearings. One type gun director takes 480 bearings, while the 4.7-inch a.a. gun remote control apparatus takes 26.

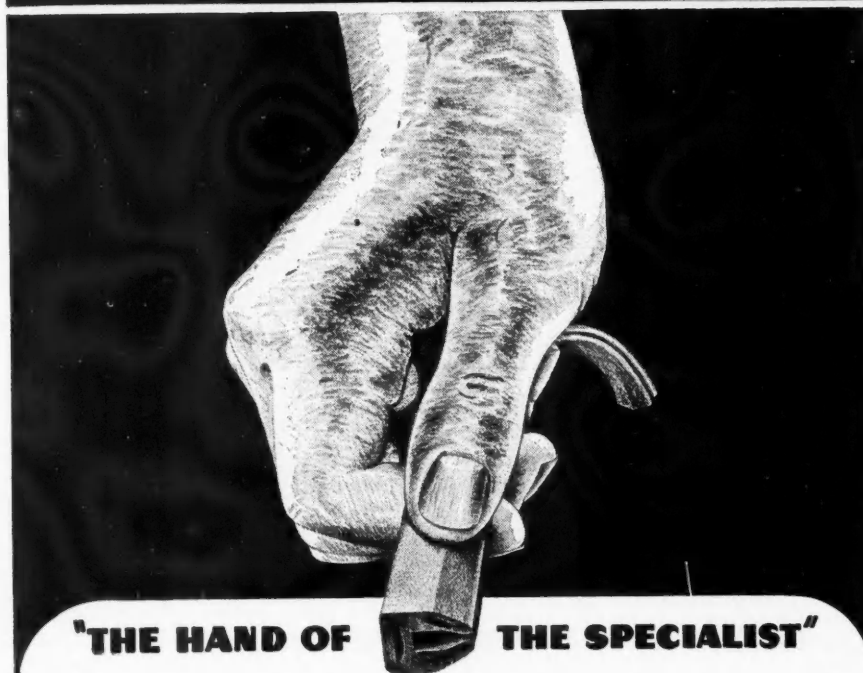
Of course the enlarged military truck program is a tremendous consumer of roller, ball and engine bearings. Military trucks, with their all-wheel drives, transfer cases, power takeoffs, winches

and dual wheels, require approximately three times as many bearings as an ordinary civilian truck of comparable capacity. A 6x6 truck requires 50 roller bearings, a half-trac 42 and a jeep 26. Nearly one and one-half million military trucks have been turned out in the last 3 1/2 years, the official total being 1,233,000 up to last Sept. 1.

Many bearing manufacturers have expanded their plant facilities, to supply the much greater need for bearings. Several new plants have been built exclusively for the manufacture of aircraft bearings. But additional new facilities are rather pointless now when there is not sufficient manpower to operate efficiently those already built.

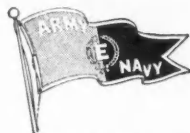
A complicating factor in the truck and tank programs, as well as in the aircraft procurement program, is the matter of spare parts. When the war began, the Ordnance Dept. had only limited military experience, plus civilian operating procedures, upon which to base its ordering of replacement parts

## CONTINENTAL RUBBER WORKS



**"THE HAND OF THE SPECIALIST"**

**The Hand of the Specialist is Prepared for the 1944 Conversion to Synthetics**



As the year comes to a close, Continental chemists are busy converting compounds from crude rubber to synthetics in accordance with Government regulations.

This task is less difficult for Continental because it worked with synthetics for many years before the war and is well prepared to meet the situation by actual experience with all types of synthetics.

The diminishing supply of crude has made further curtailment obligatory and it is now clear that little or no crude will be available in the year ahead. But despite that fact, Continental's high standard of quality will be maintained at any cost. As a result of the industry's conversion from crude to synthetics, such a wealth of experience will be gained that the products of tomorrow will be destined to perform duties and render service beyond anything previously conceived in industrial rubber goods.

**CONTINENTAL RUBBER WORKS**  
*makers of the VITALIC*



**ERIE, PENNSYLVANIA · U.S.A.**  
*line for forty years*



# THESE 7 SOLUTIONS MAY SOLVE 700 OTHER PROBLEMS...

*...perhaps your own*

## "BAKELITE" PLASTICS—Problem Solvers for Industry

When one manufacturer solves a wartime production problem by using the right BAKELITE plastic, the result may be helpful to many other manufacturers. In this spirit, we pass along here the solutions to seven typical problems, any one of which may provide the answer to yours. The plastic materials discussed are, of course, available only for highly essential uses.

Do you have a tough coatings problem? In recent tests, steel panels coated with a BAKELITE resin primer showed no blistering, pimpling, or rusting after 8,000 hours of continuous water immersion, while other primers failed at 300 hours.

Does the molding of pieces thicker than  $\frac{3}{8}$  inches, using thermosetting materials, interest you? Heatronic molding, a recent development of the Bakelite Laboratories, makes this possible, speeds curing time 10 to 50 per cent, drops molding pressure 30 to 40 per cent.

These examples are typical of the scores of developments you will be posted on if you keep in touch with Bakelite Plastics Headquarters. Our Engineering Staff and Development Laboratories have amassed a wealth of data that can help you now with your essential production problems, or with your plans for the days to come.

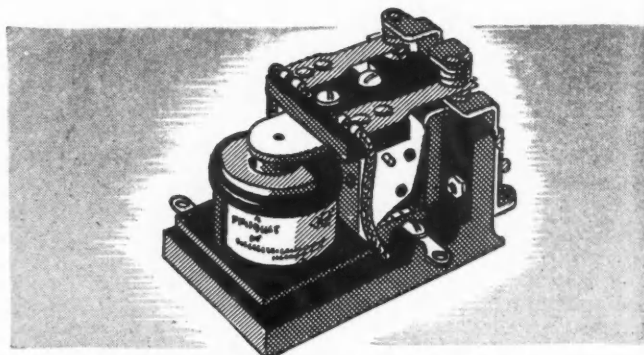
Write for specific technical literature. Please address Department 27.

### BAKELITE CORPORATION

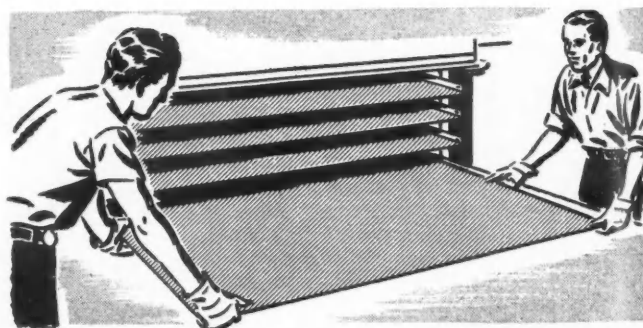
Unit of Union Carbide and Carbon Corporation



30 EAST 42ND STREET, NEW YORK 17, N. Y.



A manufacturer, wishing to eliminate the assembly of several parts normally required in small relay construction, designed an improved relay for which the base and stationary contact support were to be molded in one piece. A BAKELITE general-purpose molding material was specified for this unusual and complex construction. This material provides the desired dielectric qualities and fine finish. It also withstands the severe vibration encountered in aircraft and shipboard installations, as well as salt atmosphere and wide temperature variations—from 60 deg. F. below zero to 180 deg. F. above.



Today, plywood can be made sturdy, durable, waterproof, and weather-resistant—with BAKELITE phenolic resin glue. Wartime applications, such as the plywood airplane and glider, Army truck bodies, and Navy PT boat sections have demonstrated these properties. Recently, carloads of BAKELITE phenol-bonded plywood were sent abroad to make pontoon bridges—stub-nosed boats that will float on rivers for months at a time, withstanding weathering and hard wear.



*Useful  
Literature  
on Plastics*

**BOOKLET 27-A "BAKELITE HORIZONS"**—This pamphlet provides a brief introduction to BAKELITE plastics. Describes the origin of plastics . . . their forms, fabricating techniques, and applications.

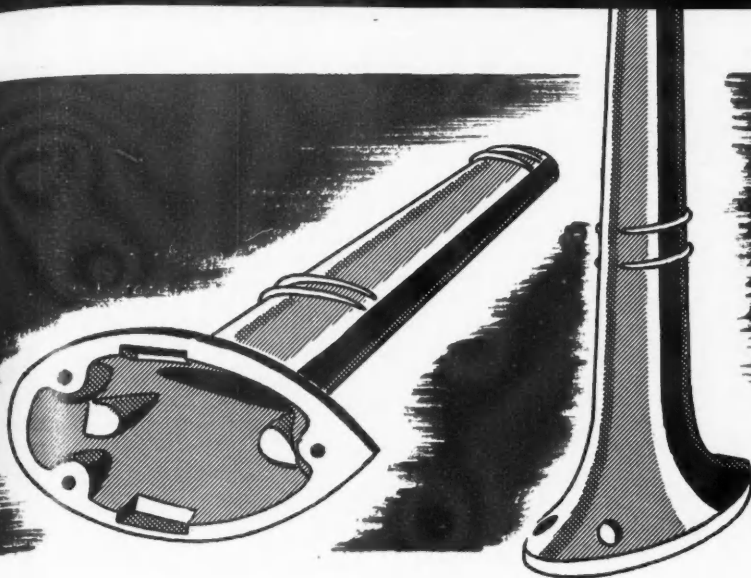
**BOOKLET 27-P "A SIMPLIFIED GUIDE TO BAKELITE PLASTICS"**—A 16-page, illustrated booklet that describes, in digest form, the various types of BAKELITE plastics and synthetic resin products.

**BOOKLET 27-M BAKELITE MOLDING PLASTICS**—A 32-page illustrated reference booklet. Gives technical

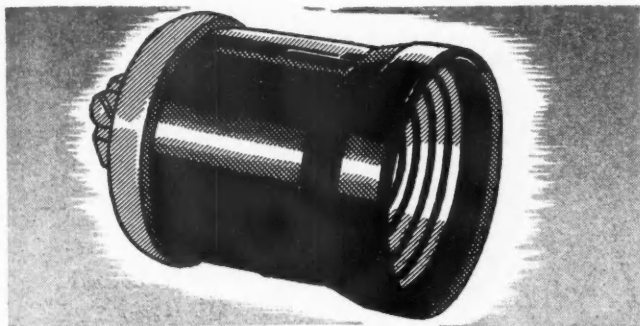
descriptions of the various BAKELITE thermosetting and thermoplastic molding materials.

**"MOLDING TECHNIC FOR BAKELITE AND VINYLITE PLASTICS" (Price \$3.50)**—A 224-page manual on the art of molding plastics. Contains latest technical data the designer, engineer, molder, and user should know about designing and fabricating hot-set and cold-set molding materials.

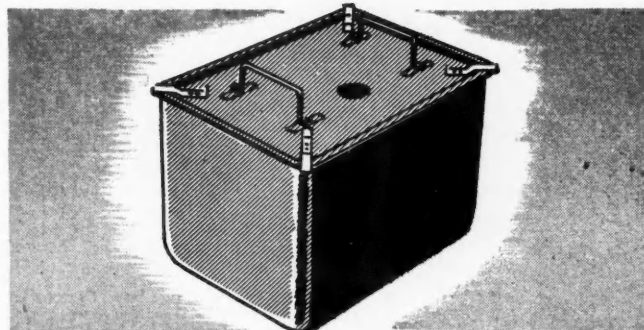
**BOOKLET 27-L "BAKELITE LAMINATING PLASTICS"**—A 24-page illustrated booklet. Describes, in detail, various



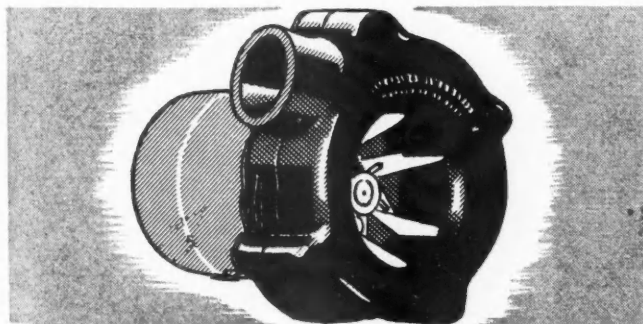
**AN INTERESTING FEATURE** of the huge Curtiss Commando troop-transport plane is its use of an extremely lightweight, yet tough and durable antenna and pitot tube, molded at low pressure using a BAKELITE laminating resin. To provide strength needed to withstand air pressures encountered in flight, the mast is molded in one piece, using a special "creped" cloth. Unlike conventional laminating cloth, this material, after it is impregnated with BAKELITE phenolic resin, is "creped" so that it can stretch in all directions in the molding process. Since the laminations remain intact, the finished mast has unusually high mechanical strength.



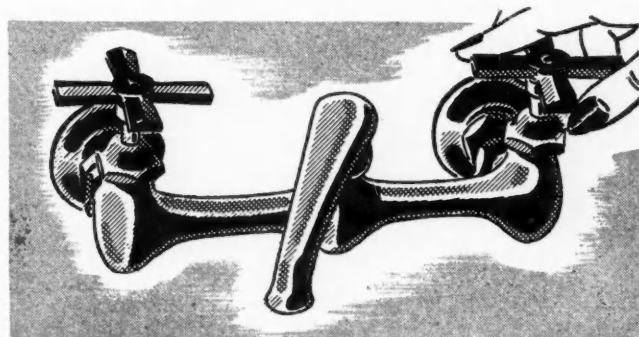
Now, lighting fixture sockets aboard America's Victory Ships are molded of BAKELITE phenolic plastics. They are lighter, more compact, and more durable than sockets previously used. The manufacturer found that less breakage and faster assembly made possible a production jump of 10 to 15 per cent . . . pushed costs down 10 per cent. The new socket has been approved for use aboard all ships of our Merchant Marine, where it will withstand vibration and extremes in temperature change.



The lining of the food containers used in Medical Corps hospital food carts must stand up against constant scraping with ladle or spoon when serving, and sudden temperature changes on sterilizing. That's a tough assignment for any coating. Yet a BAKELITE resin baking finish does the job—and does it well. Known best before the war for its use in insulating and bonding armature and coil windings, these glasslike coatings have passed many rigid requirements in meeting today's wartime needs in replacing plated linings for cans, drums, and tanks.



A tiny blower measuring only four inches in diameter, weighing only four ounces, cools the radio and other electronic equipment on America's fighting aircraft. Using a BAKELITE general-purpose phenolic molding material, the manufacturer has been able to mold the lightweight blower housing to close tolerances, yet secure good heat resistance and mechanical strength.



Army, Navy. Federal housing developments, and Navy and Maritime ships are using plumbing accessories molded of BAKELITE cellulose acetate. Five hundred thousand faucet handles have already been produced—and are proving highly successful because of their low heat transmission, good heat resistance, fine appearance, and resistance to corrosion. Other developments include a shiny white elbow, for toilet flush tanks that will not shrink or distort in service.

types of laminated plastics made with BAKELITE laminating varnishes, and illustrates many applications. Outlines fabricating techniques, and gives ASTM data.

**BOOKLET 27-V "BAKELITE HEAT-HARDENABLE VARNISH, ENAMEL, LACQUER, CEMENT"**—A 40-page illustrated booklet. Describes resin-baking coatings and bonding materials—their properties, uses, and advantages.

**BOOKLET 27-F "BAKELITE C-9 RESINS"**—A 12-page illustrated booklet for the paint and varnish technologist.

Shows how these new resins accelerate bodying time and improve performance of many surface coatings.

**BOOKLET 27-J "BAKELITE COATING PRODUCTS"**—A 4-page folder for the paint and varnish technologist, describing the new water emulsions based on C-9 resins.

**BOOKLET 27-Q "BAKELITE SEALING SOLUTIONS FOR POROUS CASTINGS"**—A 4-page folder that tells how to reclaim porous and spongy castings by impregnating with resin-baking solutions.

# BAKELITE

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## Plastics Headquarters



for military trucks. The background was even more uncertain relative to tanks, gun carriages and other armament items. Likewise, the Army Air Forces and the Navy's Bureau of Aeronautics were experienced with the servicing requirements of only a few thousand planes under peacetime conditions when the war began. Combat experience on spare parts was confined to the obsolete records of World War I or the experience of other of the United Nations early in the present war.

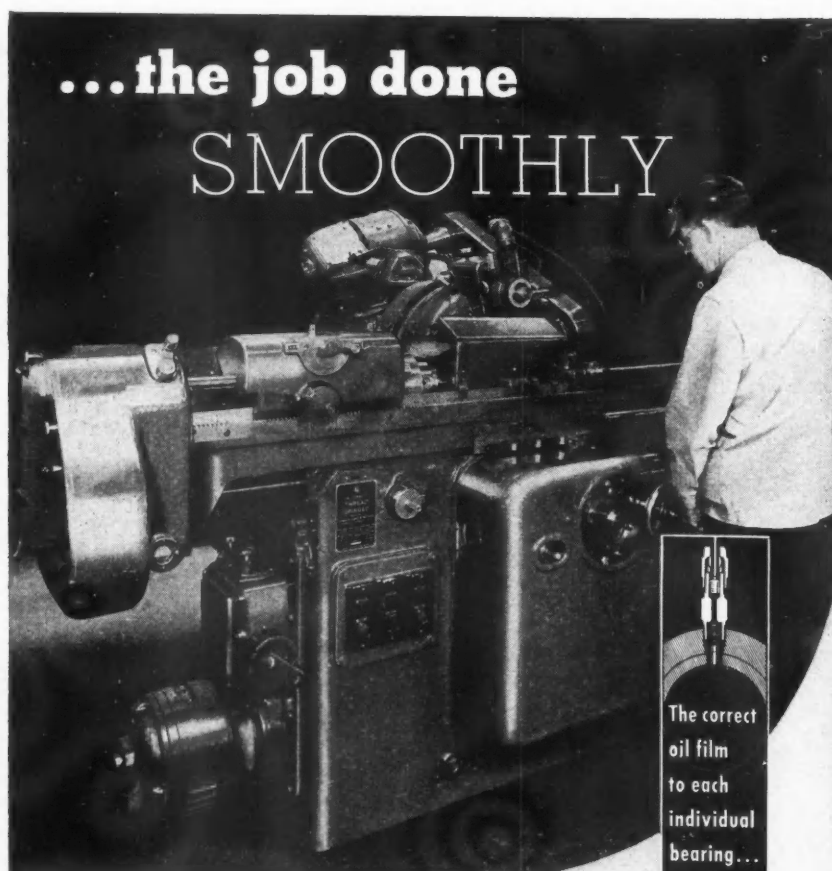
To be on the safe side, the armed services made sure of ordering enough spare parts. They attempted to fill all combat depots abroad with sufficient

spare parts, plus a certain percentage in transit, allowing for shipping losses, and then stocking all the bases and depots at home with adequate spares. The pipelines to the battle zones had to be kept filled. This was probably a wise policy from a logistic standpoint but it put an undue strain upon the manufacturing capacity of the U. S. Not only were the manufacturers supposed to maintain their schedules on completed vehicles and planes, but they also had voluminous orders for replacement parts to fill. Of course this policy has increased the load upon the bearing industry, as well as upon makers of other components.

With almost two years of war behind them, the military authorities are now able to do a more realistic job of appraising their replacement needs and ordering spare parts in adequate numbers without overtaxing industry. Orders for first and second year spares are now more in line with actual requirements, without the cushioning safety factor imposed by the procurement agencies. The Ordnance Dept. also has inaugurated a standard parts number and interchangeability program that is intended to do away with duplicate stocking of items. With similar parts ordered from one source under many various different numbers by the using manufacturers, there was bound to be considerable duplication of interchangeable replacement parts. This reached its climax when it was found that one type bearing could be found under 41 different parts numbers. With standard nomenclature and cross-indexing of interchangeable parts, much of this duplicate ordering and inventory of spares will be eliminated. This also should be helpful in reducing the load upon the bearing industry because it undoubtedly will be found that many depots have an oversupply of certain types and sizes.

The material situation has improved considerably in the last six months and is no longer much of a restricting factor in bearing production. Copper, bronze, tin and lead all are easier to obtain although there is some lack of balance in alloy steel orders. Makers of sleeve bearings have some difficulty in getting steel tubing in the proper sizes. But by and large, the material situation has eased considerably.

The Government is endeavoring to alleviate the manpower shortage as much as possible. Where labor priority plans are in effect, bearing companies undoubtedly will be given top preference. Blanket deferment of key personnel, such as was done in the Pacific Coast aircraft industry, may not be practicable in the widely scattered bearing industry, but urgent consideration of such deferments probably will be impressed upon selective service in the interests of the war effort. The wage stabilization program has proved a drawback in some respects. Bearing companies have been unable to raise their labor rates to compete with other higher paid industries. In the case of the more onerous operations, such as babbitting, prospective workers turn down proffered jobs to seek easier employment elsewhere at the same or higher wages. Incentive pay systems are in effect in a number of bearing plants but even in these there appears to be an effective ceiling on individual output. Women are employed in larger numbers by bearing manufacturers and generally make good workers, especially on the finer work on needle and tiny ball bearings. However, the general class of labor now available is not of the highest grade and production schedules suffer accordingly due to lack of efficiency.



"JONES & LAMSON" Automatic Thread Grinder... with all bearings except grinding wheel spindle Bijur-lubricated.



● No time is lost from productive work . . . a BIJUR-equipped machine oils itself, while running! Metered oil-feed—the correct oil-film needed by each individual bearing—is supplied automatically. The efficiency of operator and machine is raised . . . precision standards are held . . . maintenance is reduced to a minimum . . . production stepped up!

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AUTOMATICALLY *Correct* LUBRICATION

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• Right now, our production facilities, tool making, stamping, machining, plating and finishing are in use twenty four hours a day in the making of important war materiel.

With production flowing smoothly—our planning engineers have time on their hands which they want to put to good use. Maybe you've developed

some ideas for "after the war" products or parts that need the expert touch of deep-drawn, precision stamping specialists. If you need help in carrying your designs to a practical conclusion, make use of our available minutes to get ready for post war progress.

But we repeat, our production facilities at the present are completely engaged in war work and will continue to be so until Victory.

P. O. No. 817-20

**THE BELLEVUE MANUFACTURING COMPANY**

*Precision Made Stampings*

**BELLEVUE, OHIO**

# LIGHT

CLOSE TO THE WORK

Better lighting is a "must" in industry today—a means of attaining smoother, faster production after every other production aid has added its push.

BullDog Universal Trol-E-Duct makes possible that better lighting—brings the light right to the work—makes it easy to move or rearrange lights, or entire lighting systems, at any time and without interfering with production.

UNIVERSAL **Trol-E-Duct**



# POWER

CLOSE TO THE TOOL

Don't waste valuable production time while workers look for power outlets for portable tools. Don't risk accidents due to tripping over long cords, or shorting tangled cables.

Bring the power right to the job with BullDog Industrial Trol-E-Duct—the system that not only furnishes mobile power, but also support, for portable tools.

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MANUFACTURERS OF a complete line of Vacuum Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUS Distribution SYSTEMS.

You SAVE What You SPEND for WAR BONDS

## Inertia Scavenging And Uniflow Combined In Two-Stroke Engine

(Continued from page 25)

volumetric efficiency.

A single-cylinder engine of this type, of 36.6 cu in. piston displacement, developed a torque of 43.5 lb-ft at 1200, and 40.5 lb-ft at 2500 rpm. In the course of the experimental development it was found that in such an engine, as the cylinder dimensions are increased, the proportional height of the exhaust ports must be decreased. It was also found that an increase of 30 per cent in the height of the exhaust ports resulted in an increase of 25 per cent in the fuel consumption. A condition essential to the success of an en-

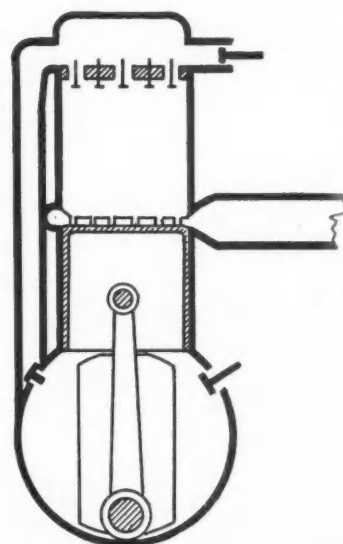


Diagram of Swedish two-stroke engine with direct current scavenging

gine of this type is said to be absolute air-tightness of the crankcase, because the crankcase pressure is higher than usual in two-stroke engines with crankcase scavenging. This engine can be operated on ordinary gasoline with a compression ratio of 7-8. Best results, however, are obtained with fuel injection, or with high octane gasoline.

A larger single cylinder horizontal engine of this type, of 750 cu in. displacement, developed 70-75 hp at 450 rpm when operated on gas-oil sprayed directly into the combustion chamber. The design illustrated is said to be suitable principally for heavy engines, and for small engines of relatively low speed.

BullDog Universal Trol-E-Duct for light, and Industrial Trol-E-Duct for mobile power, are both furnished in standardized, interchangeable sections. Both are completely salvable, suitable for quick removal to a new department or to a new plant.

Ask for complete illustrated bulletins Nos. 425 and 407, describing these two time and money saving, production speeding, BullDog systems.

**WAR BONDS**  
are the  
**BEST BUY**

STEP UP *Speed*  
CUT DOWN *FATIGUE*  
WITH **ARO**  
**PNEUMATIC TOOLS**

*New Model 101 ARO Pneumatic Drill with all-plastic housing and handle.  
... 1 lb. 12 oz. weight ... 2500 r.p.m. ...  $\frac{1}{8}$ ",  $\frac{1}{4}$ " or  $\frac{1}{2}$ " Jacobs chuck.*

● When ARO Pneumatic Tools enter your production picture...you'll find that speed and efficiency go UP, while fatigue goes down!

Because of their light weight, handy size and tremendous power...ARO Tools are demanded increasingly today for a wide range of small tool applications. This includes operations such as drilling, grinding, screw-

driving, filing, nut-setting and many special applications.

ARO helps you keep these tools in round-the-clock operation by offering immediate delivery of repair parts and excellent field service at all times. Investigate ARO Pneumatic Tools *now* for your requirements. Write for catalog. The Aro Equipment Corporation, Bryan, Ohio.





## New Production Equipment

(Continued from page 38)

but can be manually operated for set-up purposes.

Fixture spindle and slide are hydraulically actuated and are equipped with two feed rates—one for the cut through the shallow angle of the cam slot and a second, slower rate for the steeper portion of the slot. All hydraulic controls are adjustable and when once set are not disturbed until

resetting is necessary. They are located within the machine to prevent tampering.

Fixture spindle is mounted on pre-loaded, tapered roller bearings. Provision is made for take-up on the pre-load. Fixture is designed for hydraulic clamping.

The machine housing proper contains all motors except coolant motor, all hydraulic equipment, oil tank, etc. Coolant

is contained in the forepart of the lower base. A chip trough is provided in front of the base.

**T**HE Racine Tool & Machine Company, Racine, Wis., has just placed on the market a new 20 in. by 20 in. capacity Metal Cutting Machine known as their model No. 36C. This machine was designed primarily to provide low cost cutting with a thin cutting tool in large size materials. It is claimed that this machine is particularly adaptable to use on die block steel and other costly materials. The comparatively light-weight blade used removes only a small amount of metal in the form of chips, and where multiple cuts are made it is claimed a substantial saving results from this feature.

This machine is hydraulically operated, full control being placed on a



### THOSE CLOUDS *Shall be* LINED with SILVER

RATHER than wonder wishfully what Tomorrow holds in store for Business isn't it far more practical to consider what Business holds in store for Tomorrow—far more practical to make sure that silver shall line the dark clouds of war *By Putting it There?*

Even as we fight, we at Aetna are striving to do just that. In the crucible of making bearings for the galaxy of mechanized war implements, we have developed a valuable reservoir of new and better methods: better, faster, economized manufacturing processes;

new and broadened bearing size ranges; new bearing applications destined to help Industry win countless victories in Tomorrow's ceaseless battle against friction.

These war-proven developments offer stout guarantees of greater efficiency, greater economy, greater usefulness from the machines you will make or use when the longed-for days of peace arrive. Aetna Ball Bearing Manufacturing Company, 4600 Schubert Avenue, Chicago, Illinois.

In Detroit: SAM T. KELLER, 7310 Woodward Avenue, Phone Madison 8840-1-2.

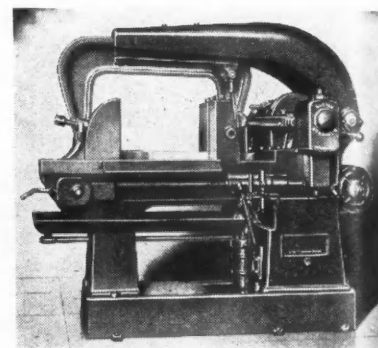


# Aetna

THRUST (STANDARD AND SPECIAL)  
ROLLER BEARINGS (SPECIAL) BALL RETAINERS

# BALL BEARINGS

AND ANGIULAR CONTACT BALL BEARINGS  
HARDENED AND GRINDING BALLS



*Racine Metal Cutting Machine*

single lever. A special dual type feed is used which provides a fast-cutting speed in light materials and yet is arranged for a positive predetermined rate of cutting in die blocks, alloys and tool steel. A three-speed transmission provides cutting speeds of 55-85 and 115 strokes per minute. A three hp. motor drive through V-belts is connected to the three-speed transmission by a Twin Disc clutch.

**U**NDER the trade name of "Plast-O-Lock," a new collect-type gage has been added to the line offered by the Turner Gauge Grinding Company, Ferndale, Mich. The "Plast-O-Lock" gage has as its outstanding feature a collet of plastic, slotted and tapered to fit into the tapered end of a standard gage holder. Hand pressure on the collet is sufficient to lock the gage in the holder and a partial turn of an end wrench unlocks it to reverse the gage or reset it at any desired protruding length.

A plastic material was selected for the collet because it will not mar a lapped or polished surface. With the "Plast-O-Lock" feature, a large holding area of plastic against the metal surface of the gage prevents scratches or burs and enables use of most of the gage's length for production purposes. The maker claims that this factor obviates the need to salvage used gages

# FOR GENERAL PURPOSE PLAIN CYLINDRICAL GRINDING ... FITCHBURG shows the way to increase production and cut costs

**6-inch Type "B"**—The Fitchburg Type "B" 6-inch automatic precision grinder features new engineering principles that result in more economical and faster production of plain cylindrical parts. Made with 18" and 32" maximum capacity between centers.

**10-inch Type "B"**—The Fitchburg Type "B" 10-inch plain cylindrical automatic precision grinder also incorporates engineering features that result in more economical and increased work production, greater accuracy, and finer finish. Made with 18", 48" and 72" maximum capacity between centers.

**Type "C" Adjustable Angular Head Grinder**  
—The Fitchburg Type "C" Angular Head grinding machine is a single application of the Fitchburg Standard Bowgage Wheel-head Unit. It is designed to handle a wide range and a number of types of jobs. The Bowgage Unit is mounted so that it may be located to grind 0 degrees up to a 45-degree included angle. Prompt deliveries can be made. Mail coupon today.

Please mail the catalog checked.

6" Type B ☐ 10" Type B ☐ Angular Head ☐

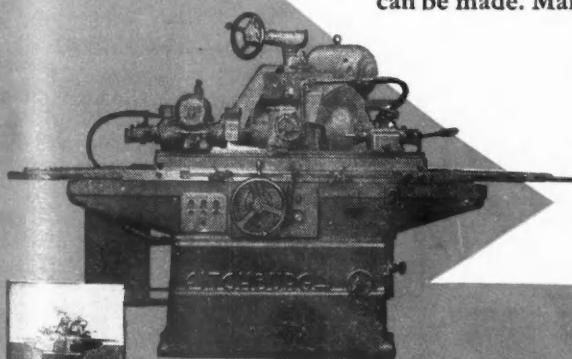
NAME \_\_\_\_\_ TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET \_\_\_\_\_ STATE \_\_\_\_\_

CITY \_\_\_\_\_ S. \_\_\_\_\_

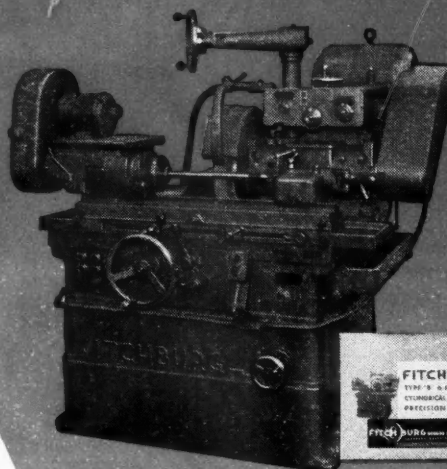
CITY



TYPE "C" ANGULAR  
HEAD GRINDER



10" TYPE "B" GRINDER



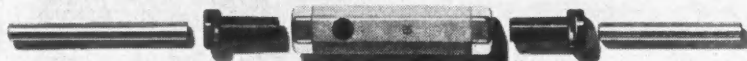
6" TYPE "B" GRINDER



## FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.



**"Plast-O-Lock" Gage**

because it will no longer be necessary or practical from a cost standpoint.

The reversible feature means a minimum of double the life of a standard plug gage, and where shallow holes are being checked, the normal life expectancy of a "Plast-O-Lock" gage will be several times greater.

As the "go" and "no go" ends are worn beyond allowed tolerances, they may simply be cut off, thus leaving an unused section ready for gaging. If a boring no deeper than  $\frac{1}{8}$  in. is being checked, as many as 8 fresh check sections may be obtained from one standard length "go" gage as furnished

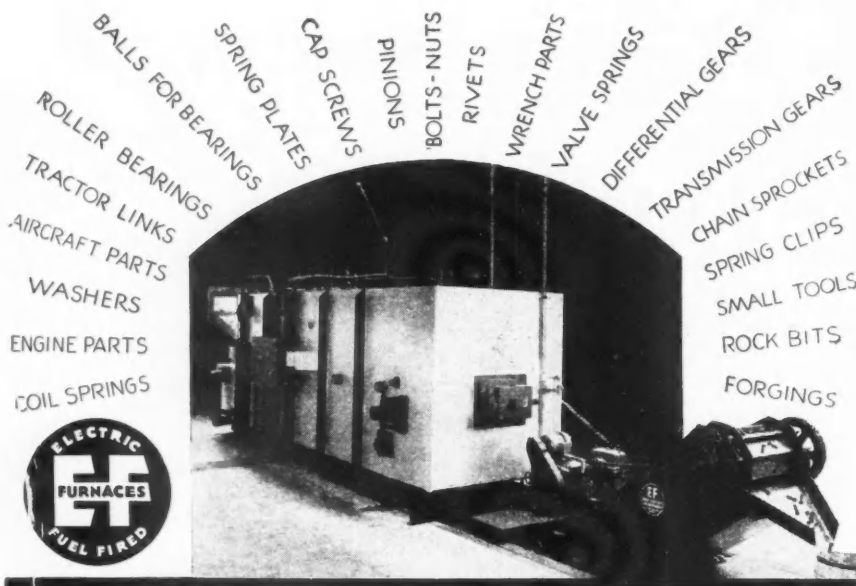
under the "Plast-O-Lock" trade name.

Used in combination with plastic gage holders, the new type gages are much lighter than steel combinations and consequently have a more sensitive "feel" in the hands of an inspector.

Because a "go" gage normally receives larger surface wear than the "no go" ends, sets are being furnished in different length in approximately the same time.

**T**HE Olson Coil Spring Filter now in production at Olson Filtration Engineers, Chicago, Ill., is a complete coolant system especially designed for coolant clarification. It has a coolant tank with easily cleanable settling-out compartments, a rotating coil-spring filter element, circulating pump, motor, and pressure relief valve.

The filter element consists of a number of tightly wound coiled springs, approximately  $\frac{3}{8}$  in. in diameter, stretched slightly between two supporting members. The fine insoluble particles in the coolant are caught on the outside of the springs, which act as porous pipes, while the filtered liquid seeps to the inside and the combined



**For Scale Free Hardening Miscellaneous Products**

**--- 300 to 1700 lbs. per Hour**

**... Investigate EF Chain Belt Conveyor Furnaces**

Hundreds of these dependable EF Continuous Chain Belt Conveyor Heat Treating units are in operation—handling all kinds of products, ranging in size from small springs, bolts and bearing parts up to large crawler links for tractors.

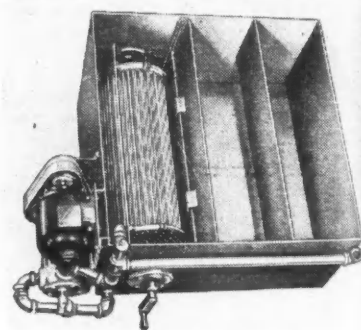
The material is loaded directly onto a rugged heat resisting cast link belt conveyor. Without further attention, it is carried through the furnace, uniformly heated to the proper temperature and automatically discharged through a sealed chute to the quenching medium or directly from the furnace as desired. The chain belt conveyor returns within the furnace without cooling . . . no pans or trays are used in the furnace . . . 100% net material.

The Chain Belt Conveyor Furnace is only one of the numerous types we build for various heat treating purposes. We build Gas Fired, Oil Fired and Electric Furnaces in various types . . . furnaces for any process, product or production.

Send for circulars showing these and other types

**The Electric Furnace Co., Salem, Ohio**

Gas Fired, Oil Fired and Electric Furnaces—For Any Process, Product or Production



**Olson Coil-Spring Filter**

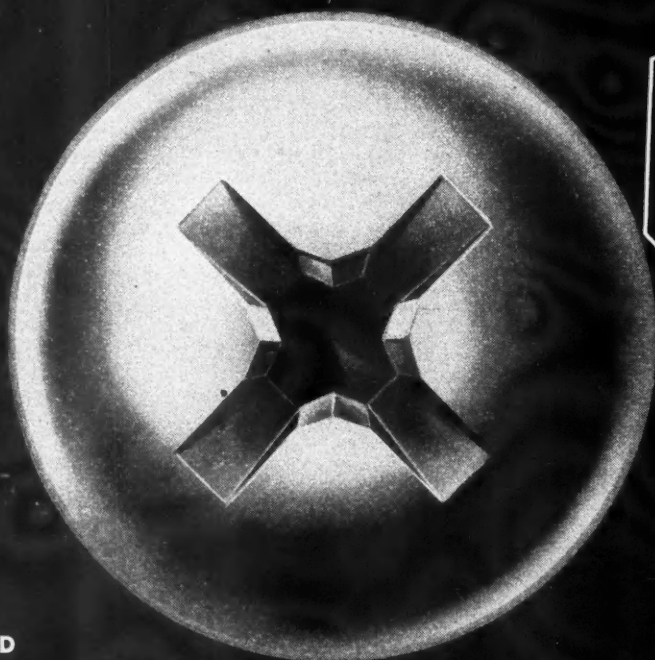
seepage flows through the springs into a header to form a large stream. One of the advantages claimed for this filter is that the spaces between the coils are movable.

At the end of the filtration cycle when cleaning is necessary, rotating the Olson coil-spring filter element in the coolant causes the springs to stretch and break up the accumulated mass of insoluble particles. The same action washes the surfaces and spaces between the coils of the springs. The sediment which falls off is automatically scraped from the filter chamber into a clean-cut compartment from which it can be removed while the filter is in continuous operation.

**A** PRODUCTION type Leadchek is announced by the Sheffield Corporation, Dayton, Ohio. It is designed for rapid and accurate checking quantities of threaded parts such as aircraft components, studs, and small shafts. It may also be used to good advantage in the receiving room or gage inspection department where quantities of identical threaded parts require checking.



# IT MUST BE RIGHT!



21 Leading Makers of Screws  
recommend the  
**PHILLIPS RECESSED HEAD**



WOOD



MACHINE



SELF-TAPPING



STOVE

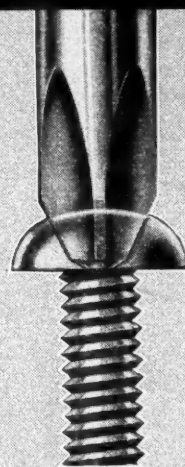
## 21 Concerns Offer the Phillips Head

AMERICAN SCREW CO. . . . .	Providence, R. I.
THE BRISTOL CO. . . . .	Waterbury, Conn.
CENTRAL SCREW CO. . . . .	Chicago, Ill.
CHANDLER PRODUCTS CORP. . . . .	Cleveland, Ohio
CONTINENTAL SCREW CO. . . . .	New Bedford, Mass.
THE CORBIN SCREW CORP. . . . .	New Britain, Conn.
THE H. M. HARPER CO. . . . .	Chicago, Ill.
INTERNATIONAL SCREW CO. . . . .	Detroit, Mich.
THE LAMSON & SESSIONS CO. . . . .	Cleveland, Ohio
THE NATIONAL SCREW & MFG. CO. . . . .	Cleveland, Ohio
NEW ENGLAND SCREW CO. . . . .	Keene, N. H.
THE CHARLES PARKER CO. . . . .	Meriden, Conn.
PARKER-KALON CORP. . . . .	New York, N. Y.
PAWTUCKET SCREW CO. . . . .	Pawtucket, R. I.
PHEOLL MANUFACTURING CO. . . . .	Chicago, Ill.
READING SCREW CO. . . . .	Norristown, Pa.
RUSSELL BURDSALL & WARD BOLT & NUT CO. . . . .	Port Chester, N. Y.
SCOVILL MANUFACTURING CO. . . . .	Waterville, Conn.
SHAKEPROOF INC. . . . .	Chicago, Ill.
THE SOUTHLINGTON HARDWARE MFG. CO. . . . .	Southington, Conn.
WHITNEY SCREW CORP. . . . .	Nashua, N. H.

Out of the many screw heads designed through the years to eliminate screw driving troubles, *only ONE* has gained wide approval by the men who should know most about screws...the men who develop and produce fastening devices.

It is highly significant that the leaders

in the screw industry... *21 concerns*... recommend the PHILLIPS RECESSED HEAD as the first recessed head that is *right* in every respect! It assures you that screw driving troubles will be ended when you specify PHILLIPS. Also, it means convenience in buying, and prompt and capable service.



## KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

**Fast Starting** - Driver point automatically centers in the recess... fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

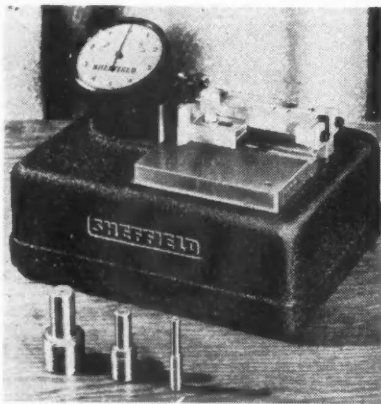
**Faster Driving** - Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

**Easier Driving** - Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

**Better Fastenings** - Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

# PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS



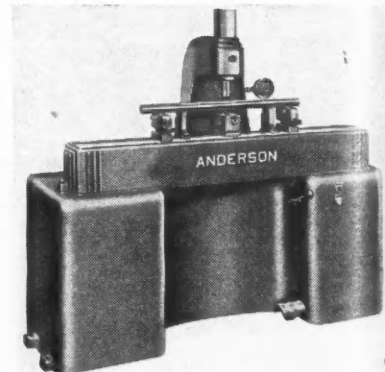
#### Sheffield Production Type Leadchek

The maker states that thread lead can be checked on this Leadchek to an accuracy of .0001 in. many times more rapidly than by any other method. The Leadchek will handle threaded length up to a maximum of two in. Threads as fine as 40 pitch or as coarse as 2 1/4 threads per inch may be checked. It will check parts having diameters ranging from .125 in. to 2 in. The gage may be obtained with a dial indicator, Electrichek or Electrigage head.

The dial indicator is of high quality

with a range of .010 in. on the dial face and is graduated in .0001 in. The gage is of simple and rugged construction with sufficient capacity for a wide range of uses in production thread checking.

**A** SENSITIVE, high speed, hydraulic straightening press, known as the Model HP-010-P, has recently been put into manufacture by Anderson Bros. Manufacturing Company, Rockford, Ill. Capacity of the new machine is 10 tons; yet it is said to be so sensitive that a shaft may be bent as little as



Anderson Model HP-010-P Press

.001 of an inch. With this press, it is possible to apply the exact load required to correct shaft run-out.

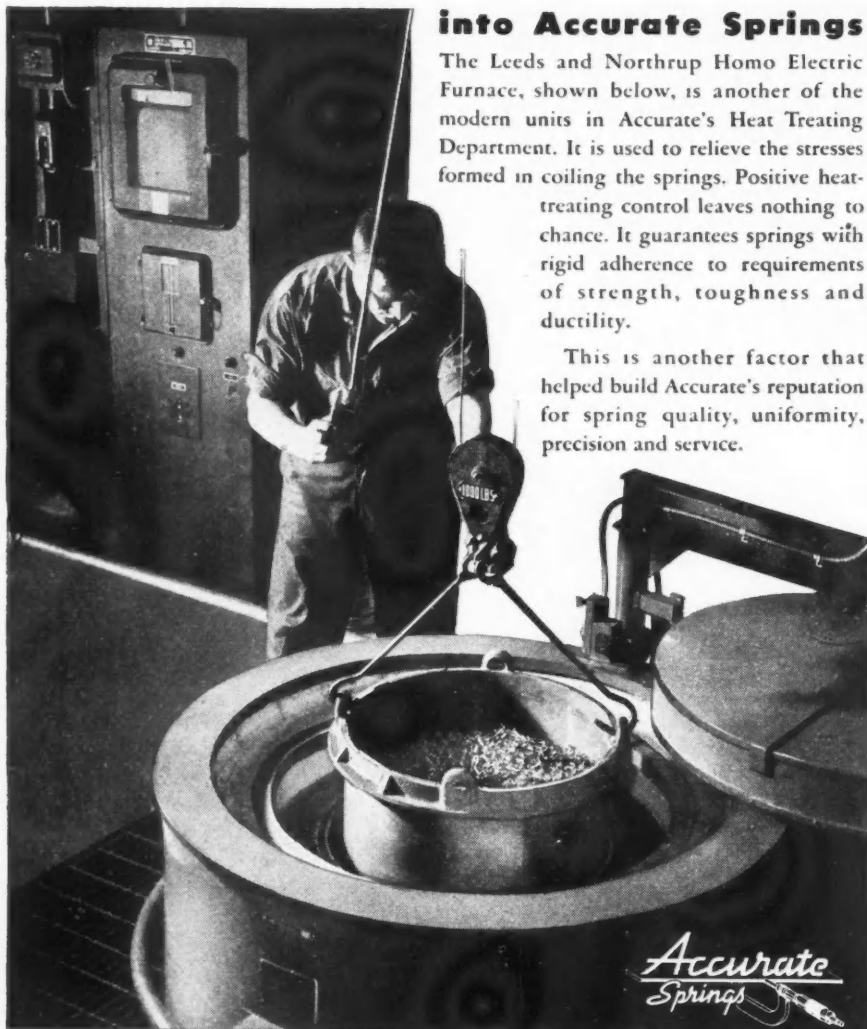
The pressure gauge, which indicates the ram loading, is mounted near the work at eye level. Beneath the ram, at the point of maximum deflection of the work piece, is located an adjustable dial indicator. This indicator shows the amount of shaft run-out in the pre-loaded, fully loaded, and unloaded positions.

## Heat Treating Quality...

### into Accurate Springs

The Leeds and Northrup Homo Electric Furnace, shown below, is another of the modern units in Accurate's Heat Treating Department. It is used to relieve the stresses formed in coiling the springs. Positive heat-treating control leaves nothing to chance. It guarantees springs with rigid adherence to requirements of strength, toughness and ductility.

This is another factor that helped build Accurate's reputation for spring quality, uniformity, precision and service.



ACCURATE SPRING MFG. CO., 3811 W. Lake St., Chicago 24, Ill.

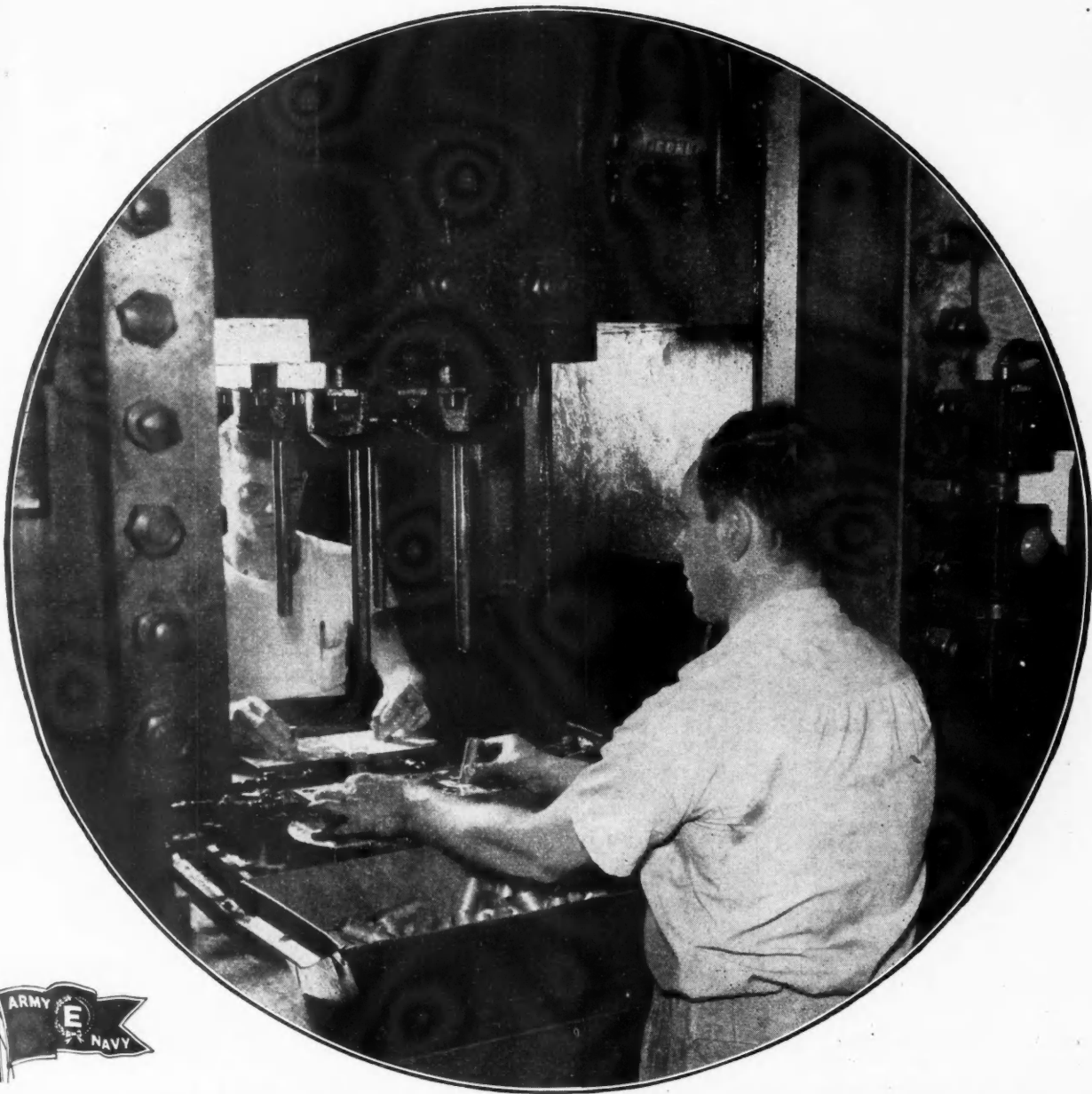
### Sound Deadening Material

(Continued from page 42)

Vibeston's usefulness, however, extends beyond that of mica. Because it is as much as fifty per cent lighter than mica, larger areas of planes can be insulated. Moreover, many planes which heretofore had to sacrifice all noise dampeners and vibration deadeners in the interest of lightness can protect the hearing of their crews through the use of the new material.

In addition to the protection it provides the fliers, the new development is said to add to the life of the plane by reducing the fatigue of aluminum.

Mass production of Vibeston is now in progress. Its use will be confined to war purposes for the duration. Its construction is such that after the war it may be used in air conditioning units and other forms of manufacture where vibration and noise are prime factors.



## METAL STAMPING *that meets* EXACTING REQUIREMENTS

A completely equipped plant for **PLASTIC INJECTION MOLDING** from a fraction of an ounce up through 18 oz. per shot.

Applying its many years of experience in the production of fine metal stampings to the manufacture of War Material, The Metal Specialty Company is completely equipped to give you efficient service in Stamping, Rolling, Coining, Forming, Drawing and Annealing in all Metals. Specialists in Hydraulic cold drawing and embossing in all metals including stainless steel. Deep drawing and embossing up to 850 tons capacity. Shells-drawn up to 20" in depth. Assembling including Flash and Resistance Seam Welding. Pressed metal products to specification.

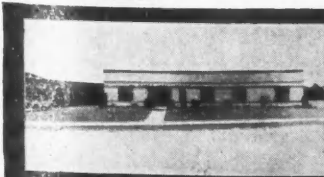
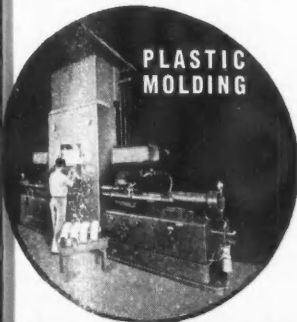
**OPERATION:** Reducing and Ironing Shells. Four each press stroke, each operator feeding two shells on Metal Specialty 850 ton hydraulic press.

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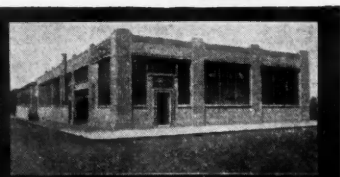
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A completely equipped plant to render you complete service in the fabrication of all **METAL PARTS**.



*The*  
**METAL SPECIALTY Co.**

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December 1, 1943

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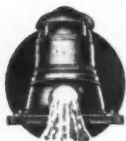
153





## VICTORY... AND LIBERTY

### It's Time to Make Postwar Plans



Victory by our Armies means new liberty for Postwar activity. Manufacturers and municipalities then can, and will be expected to go ahead with plans of progress.

Those new plans will unquestionably include Wells and Pumps to supply an adequate amount of water—water that can be produced at exceptionally low cost. The Layne Organization has foreseen and made many plans for the days of Postwar. Highly improved designs—some of which were evolved to solve critical war needs, will be instantly available for factories and cities throughout the Nation.

Layne Well Water Systems have long enjoyed absolute superiority in highest efficiency. They have established and maintained thorough dependability. Their quality has been proven by nearly three quarters of a century of service. They are better built today than even before.

For Postwar Water System planning, write for illustrated literature on Layne Pumps and Layne Well Water Systems. Address, Layne & Bowler, Inc. General Offices, Memphis 3, Tennessee.

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## LAYNE WELL WATER SYSTEMS DEEP WELL PUMPS

*Builders of Well Water Systems  
for every Municipal and Industrial Need*

## Forecast of 1943 Registrations

(Continued from page 39)

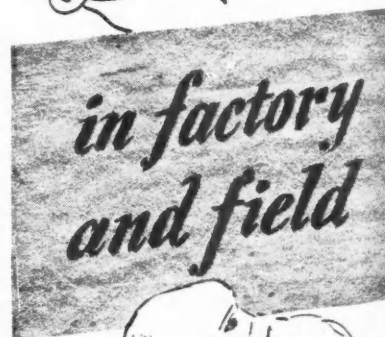
eastern area will have accounted for 48 per cent of the total loss in registrations of passenger cars though it provided only 29 per cent of the total 1942 passenger car registrations. Furthermore, the aggregate 1943 registrations of passenger cars in these 12 states and the District of Columbia will show a decline of 10.5 per cent from the same area during 1942, and the rest of the country will have declined only 4.5 per cent. Unit declines will be 840,133 passenger cars in the northeastern area and 912,445 in the remaining 36 states.

Not all of the decrease of 1,752,578 passenger cars can be attributed to scrappage alone. From authoritative sources it is indicated that approximately 900,000 passenger cars will have been brought into junk yards during the year as compared with slightly over 2,000,000 during 1942 and a normal scrappage of about 2,200,000 passenger cars. Many of these passenger cars have simply been taken out of service and stored for an indefinite period of time. Others have migrated to the Far West, South and Southwest.

In view of the essentiality of trucks and buses it is not surprising that these vehicles will indicate a decline of a mere 3.7 per cent as against the passenger car decline of 6.5 per cent. However, it is an additional astonishing example of the resourcefulness and efficiency of the truck fleet and privately owned truck maintenance men, that in the face of increased and constant use, only 176,819 trucks and buses went out of service.

Three states will show an increase in passenger car registrations, while it appears likely that 13 states will have more trucks registered this year than during 1942. California, Utah and Wisconsin have acquired additional passenger cars. Colorado, District of Columbia, Florida, Maine, Michigan, Mississippi, North Dakota, Pennsylvania, Rhode Island, Utah, Vermont, Washington and West Virginia indicate an increase in trucks and buses, though it is not at all unlikely that Mississippi, North Dakota and Pennsylvania might show a decrease when final returns are tabulated in the 1944 Statistical Issue of AUTOMOTIVE AND AVIATION INDUSTRIES. At the present time the margin of increase in these three states is less than 1 per cent. Wyoming continues with practically the same number of trucks and buses as last year. Complete details for all states will be found in the accompanying table.

Total motor vehicle registrations at the end of 1943 will be approximately the same as for those at the end of 1939, when it was considered that there were plenty of cars and trucks in the country. One factor, though, that must be taken into consideration in making



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THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

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# What?

AN ALUMINUM ALLOY THAT'S

## Stress-Corrosion-Proof!

### Frontier "40-E" under stress shows marked resistance to corrosion

Stress corrosion—the corrosive reaction which takes place when stress is applied to certain metals in the presence of corrosive atmospheres—can seriously impair the serviceability of metal members so affected.

The true "measure" of a metal intended for these service conditions is not its degree of strength properties, but the natural corrosion resistance of the alloy itself.

In a study of stress corrosion, Frontier Bronze research tested two bars of identical dimensions, clamped at the ends to develop stressed areas in the mid-section. One bar was an alloy of known high corrosion resistance. The other a bar of Frontier "40-E" Alloy. Both were subjected to a 5% salt solution for a period of 12 weeks. The unretouched photograph (left) shows the exceptional corrosion resistance of Frontier "40-E" Alloy under stress—just one of the many outstanding properties of this new development in the aluminum alloy field.

graph (left) shows the exceptional corrosion resistance of Frontier "40-E" Alloy under stress—just one of the many outstanding properties of this new development in the aluminum alloy field.

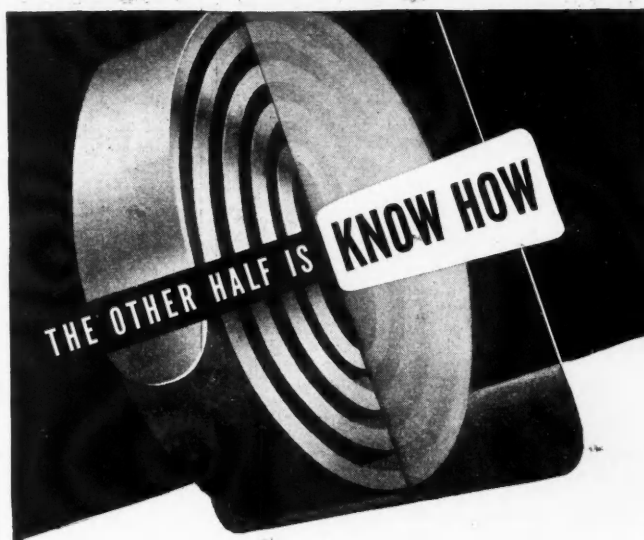
### Handy Alloy Data Book

This up-to-the-minute book contains important metallurgical and engineering information. Write for your free copy, stating your name, title, address.



**FRONTIER BRONZE CORPORATION**  
NIAGARA FALLS, N. Y.

**FRONTIER "40-E"**  
*Alloy*



**M**ETAL plus work plus heat-treating make a spring. Specifications say so. But there's something else that makes the spring more than acceptable. It's the careful inspection of materials, the skilled design of tools and dies, the right kind of heat-treatment. You don't learn to make springs from a recipe. That may give you the ingredients—but only a desire to make the best springs can produce the kind that "stay sweet" longer. Gibson spring engineers have that desire, our skilled workmen "know how."

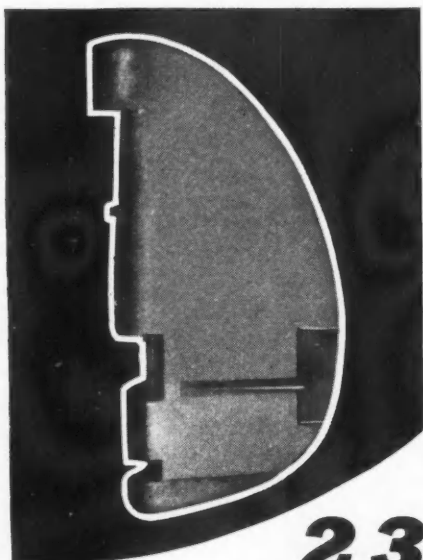
## WILLIAM D. GIBSON CO.

DIVISION OF ASSOCIATED SPRING CORPORATION

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**GIBSON-SPRINGS**



**23  
years**

OF EXPERIENCE in fabricating aircraft . . . personnel skilled in working with aluminum, aircraft steels and fabric . . . specialized equipment for forming, assembling, treating and finishing the job completely . . . the capacity to make deliveries on schedule . . . these advantages make Mercury a logical source for aircraft surfaces.

### **accessories, too**

Oil Separators for de-icing equipment, Flier's Relief Tubes and Fittings and Communication Sets for training planes are typical of the many aircraft accessories produced by Mercury in quantities which assure rush shipments.

### **NAF-47089**

We are able to make especially quick delivery on this widely used Navy Oil Separator.

AT *The Cradle of Aviation*



Be  
100%  
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## **ORTHO-HELIX** CONTROLLED DIRECTION OF FORCE **SPRINGS**



- ORTHO-Helix Springs have set new standards of excellence in accurately controlling the direction of force. Ortho-Helix Springs seat valves evenly and eliminate uneven wear on valve guides and valve stems. A demonstration test with a Helixometer will prove their extra value. Your inquiry is invited.

**American Coil Spring Co.**  
**MUSKEGON, MICHIGAN**

this comparison is the age of the vehicles today as compared with those registered during 1939. Then there were 5,400,000 vehicles registered that were less than two years old (new car and truck registrations for 1938 and 1939). Today there are practically no cars or trucks that are less than two years old even though some few might have gone into service only this year. The last authoritative count of cars in use by year of manufacture was as of July 1, 1941. (See March 15, 1942, issue of AUTOMOTIVE AND AVIATION INDUSTRIES.) At that time the age of cars in use on a percentage basis was as follows:

11.7 per cent were less than 1 year old  
11.3 per cent were from 1 to 2 years old  
8.7 per cent were from 2 to 3 years old  
6.3 per cent were from 3 to 4 years old  
12.6 per cent were from 4 to 5 years old  
11.5 per cent were from 5 to 6 years old  
7.8 per cent were from 6 to 7 years old  
5.8 per cent were from 7 to 8 years old  
4.1 per cent were from 8 to 9 years old  
2.7 per cent were from 9 to 10 years old  
17.5 per cent were 10 and over years old

All of these cars that are alive today are by now at least two years older. If we assume that the percentage of distribution by age remains approximately the same today, and that may be a slight stretching of statistical privilege, instead of 17.5 per cent of our cars being 10 or more years old, the proportion would now be 24.3 per cent or about 5,240,000 passenger cars. In prewar days the average age of passenger cars in use was four to five

years. By using the percentage table shown above, but adding two years of age to each group in it, we arrive at the possibly disputable estimate that by the end of this year only 23 per cent of the cars registered, or 5,905,000 are less than four to five years old and the remaining 19,770,000 are five or more years old. Thus we can see that the great majority of the cars registered now have lived way beyond their normal life expectancy. However, with a continuance of resourcefulness on the part of automotive maintenance men throughout the country, future scrapage should be kept at what, under existing conditions, may be considered a reasonable rate.

### **Hutchins Resigns as WPB Regional Director**

D. J. Hutchins, Detroit regional director of the War Production Board since September, 1942, has announced his resignation. No successor has as yet been named.

Hutchins returns to his pre-war post in the Detroit office of the manufacturers' sales division of the Firestone Tire and Rubber Company, which organization loaned his services to the War Production Board in February of last year.